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Science

Think and Learn

2nd prep.
First Term

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المقـــدمـــة

عزيزى التلميذ / التلميذة : ....

يسعدنــا أن نقــدم هــذا الكتاب لأبنائنــا تلاميذ الصــف الثانى الإعــدادى، ونؤكد على أن تعلــم العلوم عملية نشطــة وممتعة ومثيرة للتفكير فى تنفيذ الأنشطة العملية، وتصميم النماذج والأشكال والجداول، وكتابة التقارير والبحــوث البسيطة، والتقصى والتحقق من البيانات والمعلومات، وطــرح الأسئلة والتأمل والتواصل، والقيام ببناء التفســيرات عــن المفاهيم والظواهــر الطبيعية، وتطبيق المعرفة فــى المواقف الحياتية، وحــل المشكلات من خلال التخطيــط والتجريــب والتعلم التعاونــى، وهذه الإجــراءات والمهارات هى التــى يتناولها تعلم العلــوم القائم على الاستقصاء والتعلم النشط، واستخدام مهارة التفكير العلمى والابتكارى أو الإبداعى والنقد والتأمل.

وقــد تم اختيــار عنوان لهذا الكتاب يعكس فلسفته، وهو **فكِّر وتعلَّــم**، وقد تم الاسترشــاد فى إعداده بآراء بعض المتخصصــين فى المناهج وطرق تدريس العلوم والموجهين والمعلمين والتلاميذ، تأكيدًا لفلسفة الكتاب وأسس بنائه وتطويره، وتم تحديد فلسفة الكتاب فى ضوء المعايير القومية للتعليم وللتربية العلمية.

ويهــدف هذا الكتاب إلى مساعــدة التلاميذ على إدراك العلاقة بين العلــم والتكنولوجيا، وفهم تاريخ وطبيعة العلم، وتنمية مهــارات التفكير والمهارات الحياتية، والفهم العلمى السليم للمفاهيم الأساسية، وتنمية الاتجاهات العلميــة والقيــم الاجتماعية لتحقيــق التربية العلمية للمواطنــة وللحياة وللعمل، من خلال إثــارة تفكير التلاميذ، والاستفــادة مــن مراكز ومصادر التعلــم داخل المدرســة وخارجها، بالإضافــة إلى توظيــف استراتيجيات التعلم النشط والتعلم البنائى ولتحقيق هذه الأهداف تم استخدام مداخل متنوعة فى شكل وحدات وموضوعات دراسية مترابطة ومتكاملة مع بعضها ومع المواد الدراسية الأخرى.

ويتناول كتاب الفصل الدراسى الأول ثلاث وحدات، هى :

- دورية العناصر وخواصها
- الغلاف الجوى وحماية كوكب الأرض
- الحفريات وحماية الأنواع من الانقراض

ونحن إذ نقدم هذا الكتاب نرجو الله أن يحقق الفائدة منه.

والله ولى التوفيق،،،

المؤلفـــان

Contents

Unit 1

Periodicity of Elements and their Properties

Lessons of the unit

Lesson 1 : Attempts of elements classification.
Lesson 2 : Graduation of elements properties in the modern periodic table.
Lesson 3 : Main groups in the modern periodic table.
Lesson 4 : Water.

Sources of knowledge and learning

- Books and scientific encyclopedia

1 Greal Law in Chemistry	Mare House
2 Easy Chemistry Dorothy Paul	Lebanon Bookshop
3 Water	Family Bookshop
4 Water Steve Parker	El Farouk House

Learning objectives of the unit

At the end of this unit , the student should be able to :

1. Follow the efforts and attempts of some scientists to classify elements (Mendleev - Moseley - Modern Periodic Table)
2. Recognize the principles of elements classification in the modern periodic table.
3. Estimate scientists efforts in discovering , classifying and investing elements
4. Determine the location and properties of some elements in the modern periodic table by recognizing their atomic numbers.
5. Compare the properties of groups and periods in the modern periodic table.
6. Compare between metals, nonmetals , semimetals and inert gases in their electronic configuration and chemical activity.
7. Describe main groups in the modern periodic table.
8. Describe elements properties and their uses.
9. Use tools, materials and instruments in studying elements properties.
10. Recognize the importance of water and its sources.
11. Determine the chemical and natural properties of water.
12. Explain the irregularity of the natural properties of water.
13. Describe the chemical bonds among the atoms and molecules of water (covalent and hydrogen)
14. Recognize the polarization of some chemical compounds (Water-Ammonia)
15. Recognize the electrolysis of water.
16. Explain the equivalence of water.
17. Describe how water reacts with some of the elements of chemical activity series.
18. Determine water pollutants and their bad effects.
19. Determine the methods and measures for protecting water from pollution.
20. Estimate the importance of water locally and internationally.
21. Determine his/her personal responsibilities to protect water from pollution.
22. Make needed decisions to protect water from pollution.

Lesson 1

Attempts of Elements Classification

Lesson objectives

At the end of this lesson, the student should be able to :

1. Recognize the efforts of some scientists to classify elements.
2. Recognize the principles of elements classification in the modern periodic table.
3. Determine the location of some elements in the modern periodic table by recognizing their atomic numbers.
4. Deduce the atomic numbers of some elements by recognizing their locations in the modern periodic table.
5. Estimate the importance of discipline and organisation in our life.
6. Estimate scientists efforts in discovering , classifying and investing elements.

Points of the lesson

1. Mendleev's periodic table.
2. Moseley's periodic table.
3. Modern periodic table.

Included cases

1. Investment of environmental elements and raw materials.
2. Discipline and organisation.
3. Scientific research and its importance in discovering elements.

■ Many attempts are made by scientists for classification of elements to be easily studied, and find the relation between elements and their physical and chemical properties.

Mendeleev's periodic table is considered as the first real periodic table for classification of the elements.

Activity (1) Discovering the periodicity of the properties of elements.

Share with your classmates in co-operating groups and arrange the circles in front of you according to their colours and the graduation of their numbers in the four vertical columns in the table.

Table (1)

	Column 1	Column 2	Column 3	Column 4
Row 1				
Row 2				
Row 3				

5 10 26 22

7 15 20 30

8 16 14 12

Observations :

1. What do you observe about the graduation of numbers in the circles in each horizontal row ?

....

2. What do you observe about the repetition of colours of circles in the horizontal rows ?

....

■ The activity you did, doesn't differ from what the Russian Scientist Mendeleev did. In 1871. Fig. (1), he recorded on single cards: the names of the elements, their atomic weights and their important properties. He arranged the similar elements in vertical columns called "groups" later. He discovered that the elements were arranged in an ascending order according to their atomic weights from left to right in the horizontal rows, which were later called "periods" and their properties are periodically repeated at the beginning of each new period. Mendeleev explained his periodic table in his book "Principles of Chemistry" In 1871, and classified the known elements until this time to be (67) elements, and he also classified each main group into two subgroups (A, B) where he found differences between their properties.

Mendeleev
Fig (1)

Enrichment information (1)

* Some elements have many forms having the same atomic numbers but differ in atomic weights which known as "Isotopes".
* Read and collect information about Scientist Mendeleev. (Use magazines , encyclopedias and the internet).

Advantages and disadvantages of Mendeleev's table.

Mendeleev predicted the ability of discovering new elements. So he left spaces (empty cells) in his table, and he corrected the wrong estimated atomic weights of some elements. He had to make a disturbance in the ascending order of atomic weights for some elements, due to putting them in groups which suit their properties, and he also would have to deal with the isotopes of one element as different elements because they are different in their atomic weights.

Enrichment information (2)

In 1871, Mendeleev predicted the properties of an unknown element and named it ICA silicon that was named germanium (Ge) and its properties was the same as Mendeleev had predicted.

Self inquiry

Did you ask yourself: Why did he put more than an element in one place?

Communication

Discuss with your classmates under the supervision of your teacher about advantages and disadvantages of Mendeleev's periodic table.

Moseley's periodic table

In 1913, the Newzealand Scientist Rutherford discovered that the nucleus of atom contains positively charged protons, the British Scientist Moseley discovered in the same year after studying the properties of x rays that the periodicity of elements properties is related to their atomic number not their atomic weights as Mendeleev believed.
So Moseley rearranged the elements in an ascending order according to their atomic number such that the atomic number of an element increases by one than the element

Enrichment information (3)

* From the discoveries which have helped Moseley to put his periodic table are :
  1. Radiation activity phenomena.
  2. Getting of x-rays.
  3. The more knowledge about the arrangement of electrons in atoms.

before it in the same period, and he added the inert gases in the (0) zero group, and he lecated a place below his periodic table for the two groups lanthanides and actinides.

Exercise (1)

What is the scientific principle on which the classification of the elements based on each each of the following.

- Mendeleev's periodic table: ....
- Moseley's periodic table ....

The modern periodic table

After the Danish Scientist Bohr discovered the main energy levels fig. (2). They are 7 in the known heaviest atom so far. It was discovered also that each main energy level consists of a number of energy levels known as the energy sublevels.

- Elements are classified in the modern periodic table according to:
- Their atomic numbers and the way of filling the energy sublevels with electrons.

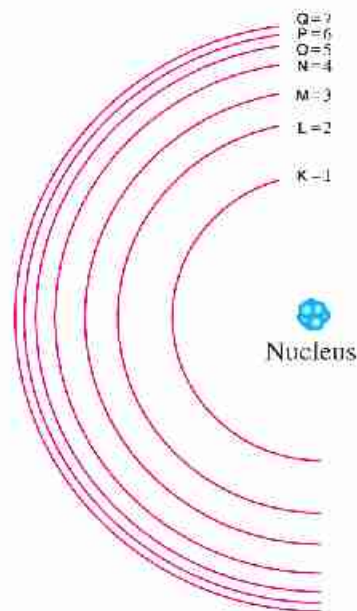
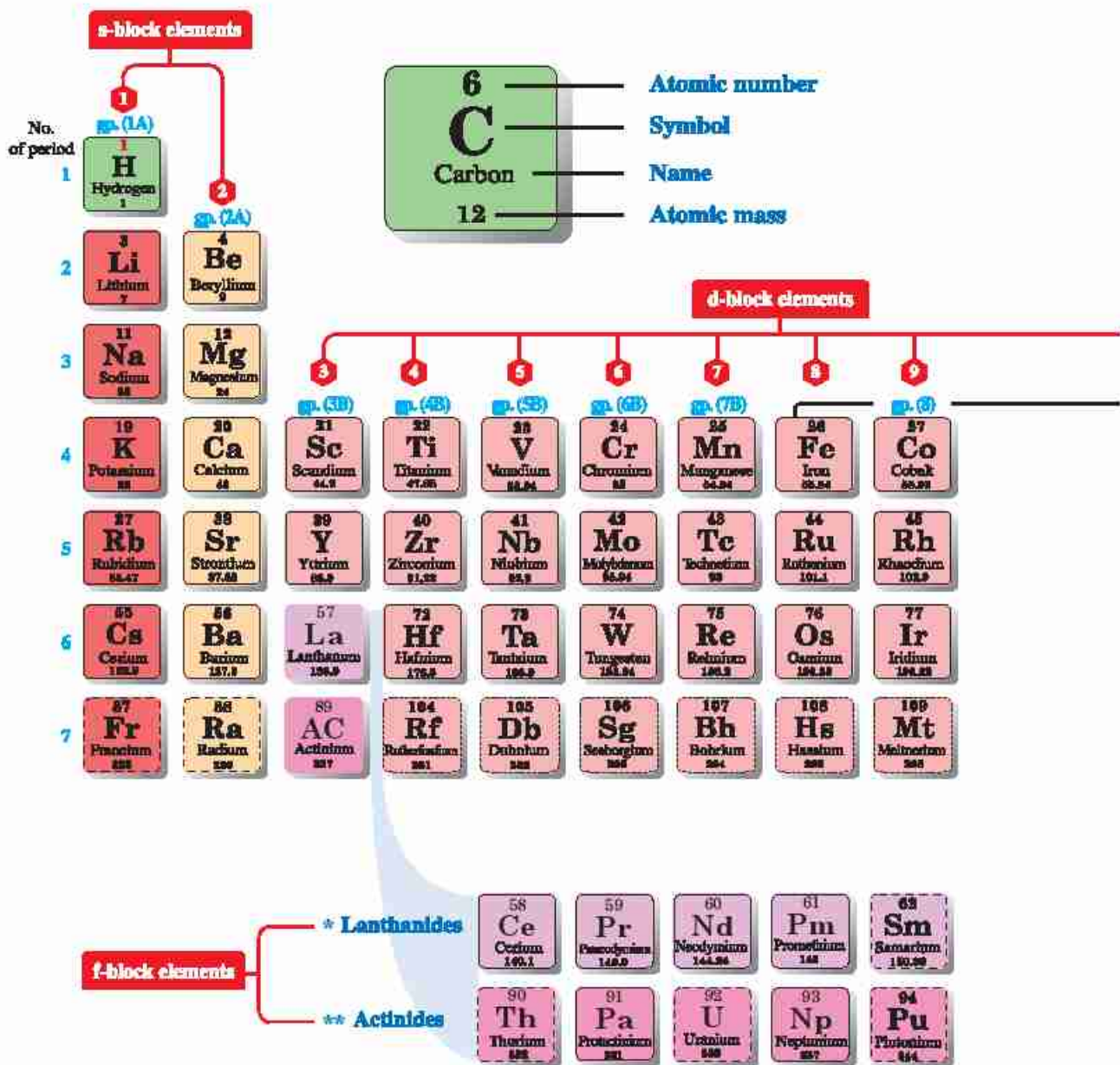



Fig. (2)

Enrichment Information (4)

Each main energy level contains a number of energy sub-levels equal to its number.
For example the main fourth energy level N consists of four energy sub-levels which are s,p,d and f.

The periodic table
Fig. (3)

P-block elements
18
gp. (0)
13
14
15
16
17
gp. (3A)
gp. (4A)
gp. (5A)
gp. (6A)
gp. (7A)
2 He Helium 4
5 B Boron
6 C Carbon 12
7 N Nitrogen 14
8 O Oxygen 16
9 F Fluorine 19
10 Ne Neon 20
13 Al Aluminum 27
14 Si Silicon 28
15 P Phosphorus
16 S Sulphur
17 Cl Chlorine
18 Ar Argon 40
10
11
12
gp. (1B)
gp. (2B)
28 Ni Nickel
29 Cu Copper
30 Zn Zinc
31 Ga Gallium
32 Ge Germanium
33 As Arsenic
34 Se Selenium
35 Br Bromine 80
36 Kr Krypton
46 Pd Palladium
47 Ag Silver
48 Cd Cadmium
49 In Indium
50 Sn Tin
51 Sb Antimony
52 Te Tellurium
53 I Iodine 127
54 Xe Xenon
78 Pt Platinum
79 Au Gold 197
80 Hg Mercury
81 Tl Thallium
82 Pb Lead
83 Bi Bismuth
84 Po Polonium
85 At Astatine
86 Rn Radon
110 Ds Darmstadtium
111 Rg Roentgenium
112 Cn
113 Uut Ununtrium
114 Fl
115 Uup Ununpentium
116 Lv
117 Uus
118 Uuo
63 Eu Europium
64 Gd Gadolinium
65 Tb Terbium
66 Dy Dysprosium
67 Ho Holmium
68 Er Erbium
69 Tm Thulium
70 Yb Ytterbium 173
71 Lu Lutetium 175
95 Am Americium
96 Cm Curium
97 Bk Berkelium
98 Cf Californium
99 Es Einsteinium
100 Fm Fermium
101 Md Mendelevium
102 No Nobelium
103 Lr Lawrencium
Alkali metals
Alkaline earth metals
Lanthanides
Actinides
Transition metals
Poor metals
Metalloids
Nonmetals
Halogens
Noble gases
State at standard tempurature and pressure
Atomic number in red: gas
Atomic number in blue: liquid
Atomic number in black: solid
solid border: at least one isotope is older than the Earth (Primordial elements)
dashed border: at least one isotope naturally arise from decay of other chemical elements and no isotopes are older than the earth
dotted border: only artificially made isotopes (synthetic elements)
no border: undiscovered

Description of the modern periodic table

Activity (2) Description of the modern periodic table

Participate with your classmates in forming co-operating groups for studying the modern periodic table and record observations for the following questions:

1. **Determine the location of s, p, d and f blocks in the periodic table.**
   ....
2. **What are the groups of s block ?** ....
3. **What are the groups of p block ?** ....
4. **What is the characterized letter for transition elements in (d) block ?** ....
   And what is the group number which is not characterized by this letter ? ....
   And what is number of vertical columns in it ? ....
5. **What is the period in which the appearance of the transition elements begins ?** ....
6. **What are the numbers of periods and groups of the modern periodic table ?** ....
7. **What is the new number for 0 group (inert gases) and 5A group?**

From studying the modern periodic table:

- **The number of known elements until now are 118 elements, 92 elements are abundant in the earth's crust, the rest of the elements are prepared artificially.**
- **Elements of (A) groups lie on the left and right of the table, you can locate their position in the modern periodic table by knowing their atomic numbers and vice versa.**
- **The elements of (B) groups lie in the middle of the table** Starting From The Fourth Period and including 10 Groups Known as Transition elements.

Enrichment Information (5)

(1) Recently discovered elements are not found in nature but they are prepared artificially.

(2) These elements are radioactive elements, their nuclei are decayed in less than a second.

(3) Use Excel Program in drawing a table that explains periods and groups of periodic table.

Exercise (2)

Mention the kind and the block of the element, which is located in group 3B and fourth period.

Life application | House library

House library figure (4)

- Form a bookstore at your home (Use Family Library - school library).
  Apply what you have studied about the elements classification in arranging them in horizontal rows and vertical columns.
  including the subject of the book (scientific, historical, religious, ...) and making an index for the books to facilitate the search process.

Activity (3) Determination of the position of the element in the periodic table by knowing its atomic number

Participate with your classmates in the co-operating group to do the following activity.

Steps :

1. Write the electronic configuration for elements explained in the table (2).
2. Determine the number of energy levels, the number of electrons in the outermost energy level for each element.
3. Determine the number of period and group for each element (Use the modern periodic table).

Table (2)

Element	$_{20}Ca$	$_{15}P$	$_{10}Ne$	$_{1}H$
* Electronic configuration	+20	+15	+10	+1
* Energy levels	....	....	....	....
* Number of period	....	....	....	....
* Number of electrons in outermost energy level	....	....	....	....
* Number of group	....	....	....	....

Observation :

1. What is the relationship between the number of energy levels occupied by electrons in the atom of the element and its period number ?

....

2. What is the relationship between the number of electrons in the outermost energy level of the atom of the element and its group number ?

....

Conclusion :

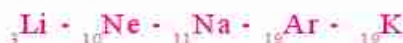
1. Number of period of the element = Number of energy levels occupied by electrons in its atom.
2. Number of the group of the element = Number of electrons in the outermost energy level in its atom.

Exercise (3)

Classify the elements into two groups :

$_{3}Li$ - $_{10}Ne$ - $_{11}Na$ - $_{18}Ar$ - $_{19}K$

....

....

Activity (4) Determination of the atomic number of the element by knowing its location in the periodic table.

Participate with your classmates in the co-operating groups to do the following activity.

Steps :

1. In the table (3) determine the number of energy levels occupied by electrons for each element by knowing its period number.
2. Write below the outermost energy level of each element, the number of electrons in it by knowing the number of its group.
3. Complete the number of electrons in the inner energy levels filled with electrons for each element by knowing the number of its group.
4. Write the number of positive protons inside the nucleus for each element by knowing the number of electrons.

Observations :

❶ What is the atomic number of F and Ar ?

....

....

....

❷ What is the expected atomic number for S and Cl ?

....

....

....

Table (3)

Group / Period	5A	6A	7A	0
Second period	N (+7)	O	F	Ne
Third period	P	S	Cl	Ar

❸ Can scientists discover a new element between S and Cl ?

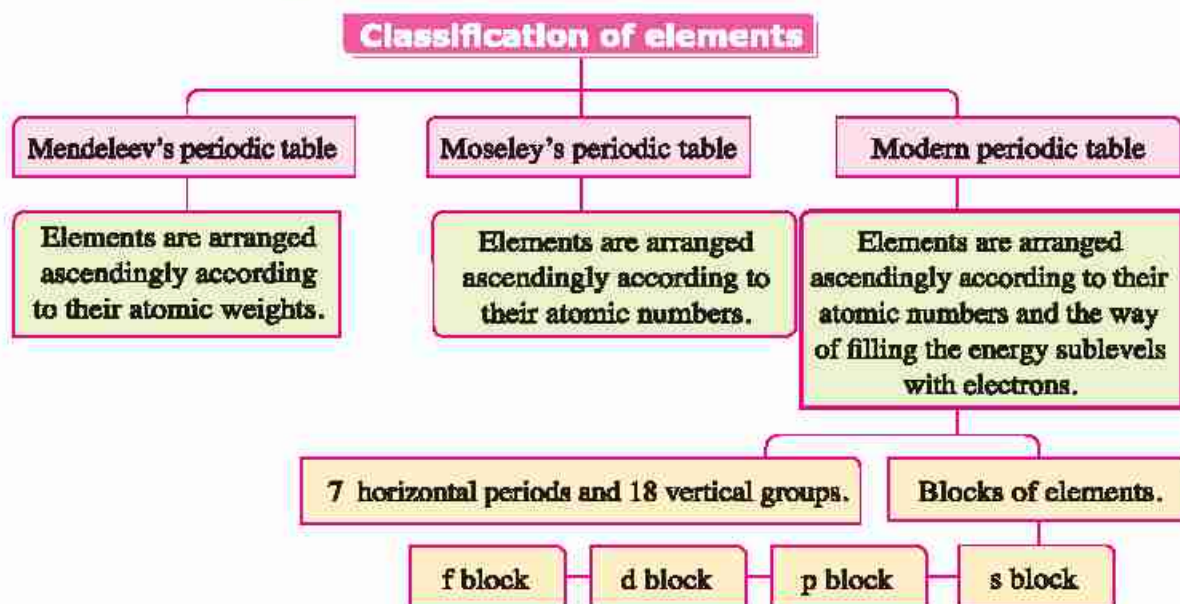
....

Conclusion :

1. The atomic number of an element = Sum of the number of electrons which rotate around the nucleus of its atom and also = The number of protons in the nucleus.
2. The atomic number of an element is a whole number increasing through periods from one element to the following element by (1).

A case for discussion | **Development of scientific and life concepts**

1. The classification of elements passed several stages, each of them tried to avoid the mistakes of its predecessors and benefitted from the newly established theories, experiences and scientific results.
   * Discuss this issue with your classmates under the supervision of your teacher issuse and these questions should be a part of the subject of discussion.
2. Is what you believe in today will remain for ever in your mind ?
   * Which do you prefer to complete your tasks and scientific researches, individual work or group work ? Why ?
   * From where do you gain your experience, your personal experiences or the experiences of others ?
   * Is there a relationship between the development of scientific concepts and societal changes ?

Lesson summary

- Each main energy level contains a number of energy sublevels.
- Transition elements start to appear in the fourth period.
- Number of period of the element = Number of energy levels occupied by electrons.
- Number of group of the element = Number of electrons in the outermost energy level in its atom.

Evaluation on lesson 1

1 Complete:

(1) The scientist Mendeleev arranged the elements ascendingly according to ....
while The scientist Moseley arranged them ascendingly according to ....

(2) The modern periodic table consists of .... horizontal periods , ... vertical groups.

2 What is the scientific base on which the modern periodic table classified ?

3 Locate the position of the following elements in the modern periodic table :

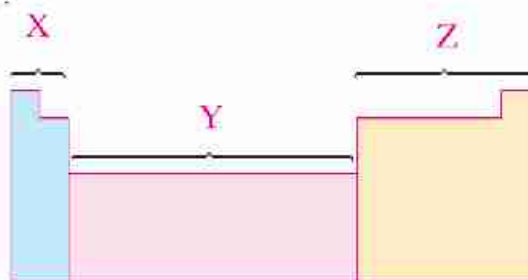
(1) ${}_{1}H$ ....
(2) ${}_{10}Ne$ ....
(3) ${}_{20}Ca$ ....
(4) ${}_{11}Na$ ....
(5) ${}_{13}Al$......................
(6) ${}_{18}Ar$ ....

4 Find the atomic number for the following elements.

(1) Element X lies in the first period and zero group ....

(2) Element Y lies in the second period and 3A group ....

(3) Element Z lies in the third period and 7A group ....

5 Notice the following figure which represents a part of the modern periodic table, then answer the following :

(1) What are the names of blocks which are characterized by the letters X , Y , and Z ?

....

(2) What is the number of groups in each block ?

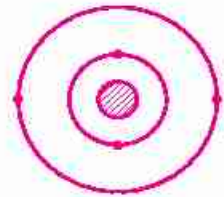
....

	X	Y	Z
block name			
number of group			

(3) What is the number of 7A group and zero group ?

....

6 Study the opposite figure which

explains the electronic configuration for an element in the modern periodic table and conclude the atomic number of the element which follows this element in :

(1) The same period ....

(2) The same group ....

7 Creative Thinking :

Imagine a new form of classification of elements which their atomic numbers range between 1 - 20 such that each group contains similar elements.

....

....

Search in your school library or internet for the attempts which precedes Mendeleev's attempt for classification of elements.

Lesson 2

Graduation of Elements in the Modern Periodic Table

lesson objectives :

At the end of the this lesson, the student should be able to:

1. Determine the properties of some elements by knowing their atomic numbers.
2. Compare between some elements according to the electronic configuration and the chemical activity.
3. Identify metals, nonmetals and metalloids.
4. Compare between the properties of the groups and the periods of the periodic table.
5. Identify the polarity of some chemical compounds.
6. Identify the behaviour of some metals of the chemical activity series with water.
7. Use tools and substances discovering the chemical properties of metals and nonmetals.

Points of the lesson :

1. Atomic size property.
2. Electronegativity property.
3. Metallic and nonmetallic property.
4. Chemical activity series.
5. Chemical properties of metals.
6. Chemical properties of nonmetals.

Included cases :

1. Using of the elements and environmental resources.
2. Graduation of responsibilities of both personal and social decisions.
3. Integration of responsibilities and roles.

This lesson discusses the graduation of some elements properties in the periods and the groups (A) in the periodic table and the relation between these properties and the electronic configuration of elements.

1 Atomic size property :

The atomic size is determined by knowing the atomic radias. and measured in picometre = $1x10^{-12}$ m

1- Picometre equalize one part of million million part of meter.

Activity (1) Discovering of the graduation of atomic size in the periodic table.

Think carefully with your colleagues in the co-operating group (figure 1) and record your observations on the following questions :

What do you observe for the graduation of the values of the atomic size of elements in relation to the increasing of the atomic number ?

- In periods

....

- In groups

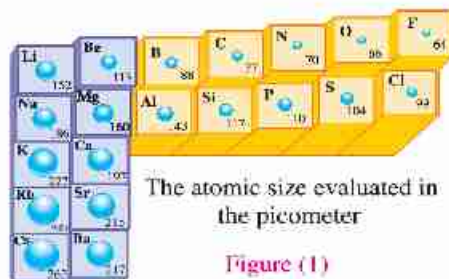
....

The atomic size evaluated in the picometer

Figure (1)

«Picometer = part of a million of a million of metre»

From the previous, we conclude that:

1. The atomic size of the same period decreases by the increase of their atomic numbers. Due to the increase of the attraction force between positive nucleus and the electrons in the outermost energy level.
2. The atomic size of the same group increases by the increase of their atomic numbers due to the increase of the number of the energy levels in the atoms.

2 The electronegativity property:

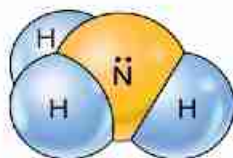
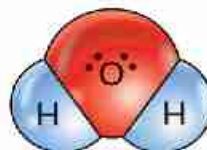
It is defined as the ability of the atom in the covalent molecule to attract the electrons of the chemical bond towards itself. as that in water molecule and ammonia molecule that are known as a"polar compounds".

Polar ammonia molecule

Polar water molecule

Figure (2)

The Polar Compound is a Covalent Compond where The difberence in electrone gativity be tween its elements is relatively large

Self inquiry

Did you ask yourself about the relationship between the electronegativity and the polarity of some compounds like CH_4 methane gas, H_2S hydrogen sulphide?

Enrichment information (1)

the covalent bond is described as pure when the electronegativity difference between the two joined atoms equal zero

What is the kind of covalent bond in oxygen molecule ?

Communication

Discuss with your classmates and your teacher the owner of classification idea into metals and nonmetals.

3 The metallic and nonmetallic property:

– Elements are divided into 4 main kinds, which are :

- Metals.
- Nonmetals.
- Semimetals (Metalloids).
- Inert gases.

Metals are characterized by that their outermost shells contain less than (4) electrons and tend to lose these electrons during the chemical reaction. To reach the nearest inert gas preceding them in the periodic table, forming positive ions.

- What do you expect the number of valenc shell electrons for nonmetals will be ?

....

- What kind of ions which are formed by nonmetals? ....
  What is your explanation? ....

Some elements have both properties of metals and nonmetals which are known as metalloids.

Like Boron - Silicon - germanium - Arsenic - Antimany - Telcrium

Activity (2) Discovering the graduation of the metallic and nonmetallic properties in the periodic table.

Colour some cells of elements of the periodic table as shown in Figure (3) as follows:

- Metals with red colour.
- Semi-metals with yellow colour.
- Nonmetals with green colour.
- Inert gases with blue colour.

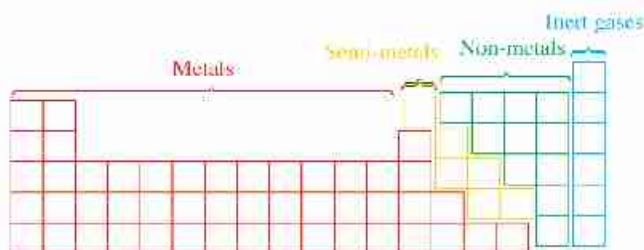



Figure (3)

Record your observation on the following questions.

- What is the kind of the element by which the period starts ? ....
- What is the kind of the element by which the period ends ? ....
- What is the kind of element which precedes the inert gas in each period ? ....

From the previous, we can conclude :

- The period starts with strong metal, as the atomic number increases in the same period the metallic property decreases gradually until we reach semimetals and then nonmetals start appear and as the atomic number increases, the nonmetallic property increases until we reach the strongest nonmetal in group 7A.
- Metallic property of the same group increases by the increase of the atomic number as we go from up to down (as in group 1A) due to the increase of the atomic size, while nonmetallic property decreases (as in group 7A)

Exercise (1)

Classify the elements of the third period in the periodic table according to their kinds. Use the modern periodic table fig. (3) on page (10 , 11).

....

The chemical properties of metals :

To know the chemical properties of matals partitipate, with your classmates in the co-operating group under the supervision of your teacher to do the following activity.

Activity (3) Discovering the chemical properties of metals.

Substances and tools :

- Magnesium strip.
- Water.
- A jar filled with oxygen.
- Test tube.
- Dilute hydrochloric acid.
- Holder.

Steps :

1. Put a piece of magnesium strip in the test tube, then add the dil. hydrochloric acid.
2. Heat another piece of magnesium strip using the holder till glowing and put it in the jar filled will oxygen fig (4).
3. Add some water to the jar with shaking.

Burnning of magnesium in oxygen
Figure (4)

Observations :

1. Does magnesium oxide dissolve in water ?

   ....

2. What is the effect of adding drops of violet litmus to the solution formed in the jar fig (5)? ....

The effect of adding violet litmus to magnesium oxide solution
Figure (5)

Conclusion :

magnesium reacts with hydrochloric acid.
Figure (6)

1. Some metals react with dilute acids forming salt of acid and hydrogen gas fig (6).

$$Mg + 2HCl \xrightarrow{Dil.} MgCl_2 + H_2\uparrow$$

Magnesium + Hydrochloric acid → Magnesium chloride + Hydrogen

2. Metals react with oxygen forming metallic oxides which are known as basic oxides.

$$2Mg + O_2 \xrightarrow{\Delta} 2MgO$$

Magnesium + Oxygen → Magnesium oxide

3. Basic oxides which dissolve in water form alkalis:

$$MgO + H_2O \longrightarrow Mg(OH)_2$$

Magnesium oxide + Water → Magnesium hydroxide

Enrichment information (2)

A mixture of MgO , $MgCl_2$ and H_2O in making stones for making blades of knives which are very thin. (Sharpening knives).

- Metals are arranged descendingly according to their Chemical activity known as "chemical" activity series, the chemical activity of metals with water is different according to their position in the series as shown in the table (3).

Table (3)

K Potassium and Na Sodium	React instantly with water and H_2 evolves which burn with a pop sound
Ca Calcium and Mg Magnesium	React very slowly with cold water.
Zn Zinc and Fe Iron	React in high temperature with water vapor only.
Cu Copper and Ag Silver	Don't react with water.

Enrichment information (3)

High concentration of sodium ions Na^+ in the body causes high blood pressure so high blood pressure patients are recommended to decrease using table salt in foods.

Read and collect information about the importance of the different elements in food .

Life application | **Cleaning silver tools**

- Cover the bottom of a plastic plate with an aluminium paper (foil), whereas the bright surface is upward.
- Put on the aluminium paper the silver tools which you want to clean.
- Cover them by enough boiling water and then put (3) spoons of baking powder.
- Leave the tools for 15 minutes with stirring.
- Dry the tools after rinsing them with hot water.

Glittering silver plate
Figure (7)

The chemical properties of nonmetals :

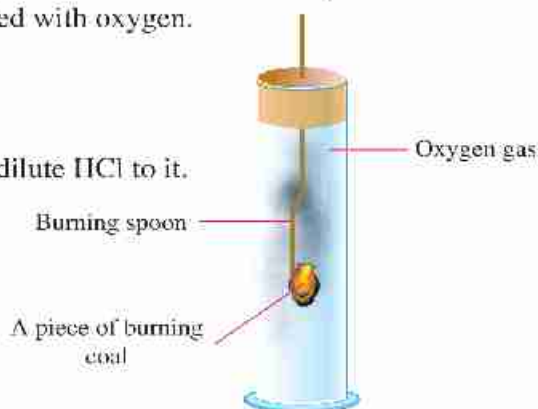
To know the chemical properties of nonmetal elements, Participate with your classmates under the supervision of your teacher to do the following activity.

Activity (4) **Discovering the chemical properties of nonmetals.**

Substances and tools :

- Two pieces of coal (Carbon).
- Burning spoon.
- Two test tubes.
- A jar filled with oxygen.
- Dilute hydrocholric acid.

Steps :

1. Put a piece of carbon in the test tube, then add dilute HCl to it.
2. Heat the other piece of carbon in the burning spoon till it burns, then put it in the oxygen jar fig (8).
3. Add some water in the jar with shaking.

Burning of carbon in oxygen
Figure (8)

Observations :

1. Does a reaction take place between carbon with the acid ?

....

2. What is the effect of adding drops of violet litmus solution to the formed solution in the jar figure (9) ?

....

Conclusion :

- Nonmetals don't react with acids.
- Nonmetals react with oxygen forming non-metal oxides. Most of them are known as acidic oxides.

$$\underset{\text{Carbon}}{C} + \underset{\text{Oxygen}}{O_2} \xrightarrow{\Delta} \underset{\text{Carbon dioxide}}{CO_2}$$

- The nonmetal oxide dissolves in water forming acids.

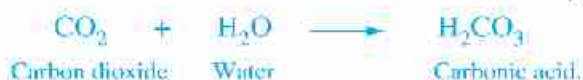
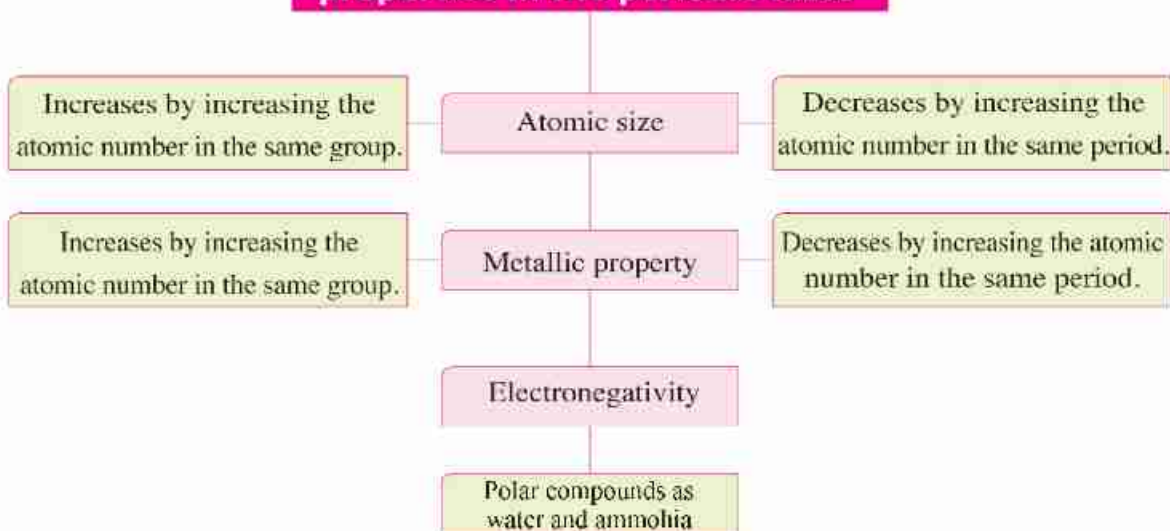
$$\underset{\text{Carbon dioxide}}{CO_2} + \underset{\text{Water}}{H_2O} \longrightarrow \underset{\text{Carbonic acid.}}{H_2CO_3}$$

The effect of adding violet litmus solution to the acidic solution

Figure (9)

> **Enrichment information (4)**
>
> Some element oxides like aluminium oxide Al_2O_3 are called amphoteric oxides because they react with acids as basic oxides react with bases as acidic oxides and give in both cases salt and water.

Lesson summary

Graduation of the elements properties in the periodic table

Group	Property	Period
Increases by increasing the atomic number in the same group.	Atomic size	Decreases by increasing the atomic number in the same period.
Increases by increasing the atomic number in the same group.	Metallic property	Decreases by increasing the atomic number in the same period.
	Electronegativity	
	Polar compounds as water and ammonia	

- Electronegativity : Is the ability of an atom in the covalent compound to attract the bonded electrons to itself.
- Water and ammonia gas are from the examples of polar compounds.
- The properties of semimetals look like the properties of both metals and nonmetals.
- Chemical activity series : Is the descending arrangement of elements according to their chemical activities.

Questions on lesson 2

1 Put (✓) or (✗) in front of the following statements and correct the wrong ones:

(1) The atomic size increases by the increase of the atomic number. ( )

(2) Water and ammonia are from polar compounds. ( )

(3) Some alkalis dissolve in water forming bases. ( )

(4) The solutions produced from dissolving the non-metal oxides in water turn the violet litmus solution into red. ( )

2 Choose the correct answer between bracktes:

(1) Each period in the modern periodic table starts with .... element.

(metallic - semimetallic - nonmetallic - inert)

(2) When sodium reacts with water, ... gas evolves. (O_2 - CO_2 - H_2 - N_2)

3 What is meant by ....?

(1) Metalloids ....
(2) Chemical activity series ....

4 Explain the behaviour of the following elements with water:

(1) Iron .... (2) Silver .... (3) Potassium ....

5 Write the balanced chemical equations which express reaction of :

(1) Carbon dioxide with water.

....

(2) Magnesium with dil. hydrochloric acid.

....

Lesson 3

The Main Groups in the Modern Periodic Table

Lesson objectives :

At the end of the this lesson, the student should be able to:

1. Determine the valency of alkali metals.
2. Describe the behaviours of alkali elements in the chemical reactions.
3. Deduce the general properties of alkali metals.
4. Determine the valency of alkali Earth metals.
5. Describe the behaviour of alkali Earth metals in chemical reactions.
6. Deduce the general properties of alkali Earth metals.
7. Compare between the properties of alkali metals and alkali Earth metals.
8. Define halogen group.
9. Deduce the general properties of halogens.
10. Appreciate the importance of alkali metals and alkali Earth metals in our life.
11. Describe the properties of elements and their uses.
12. Appreciate the role of scientists and their efforts in studying elements and their uses in our life.

Points of the lesson

1. Alkali metals group.
2. Alkali Earth metals group.
3. Halogen group.
4. Inert gases group.
5. Properties of elements and their uses.

Included cases :

1. Making use of elements, resources and environmental ores.
2. Appreciating the role of science, scientists and scientific research in our life.

- Some of the main groups in the periodic table are characterized by Specific names as explained in this lesson.

Description of some groups.

1 Alkali metals group (Group 1A) :

The place of the alkali metals group in the periodic table.
Figure (2)

Fr 87 Francium

Alkali metals
Figure (1)

Observe and think carefully about the position of alkali metals in the periodic table (Fig.1) group 1A lies in the maximum left of the periodic table (Fig.2) and their metals are named alkali metals because they react with water forming alkali solutions.

$$2\,Na + 2\,H_2O \longrightarrow 2\,NaOH + H_2$$

Sodium Water Sodium hydroxide Hydrogen

- What is the block of elements of group (1A)? ....
- What is the valency of alkali elements ? ....
- What is the behaviour of the alkali elements atoms in the chemical reactions ?
  ....
- Do alkali metals conduct heat and electricity ?
  ....

Identify the other properties of alkali metals, participate with your classmates under the supervision of your teacher to do the following activity.

Enrichment information (1)

*Although hydrogen gas exists in group A1, it is a nonmetal because its atom is remarkably small and it's a gaseous element.

*Search for the other similarities between hydrogen, metals and nonmetals.

Discovering the properties of alkali metals

Substances and tools :

- A very small piece of sodium.
- A very small piece of potassium.
- Filter paper.
- Basin.
- Water.

Steps :

1. Take out a sodium piece (pea size) from the kerosene in which sodium is kept. fig. (3)
2. Roll the sodium piece in the filter paper and put it carefully in the water basin.
3. Repeat the previous steps with potassium.

Figure (3)

Observations :

1. Why are Na and K kept under kerosene?
   ....
2. Which is stronger when reacting with water Na or K?
   ....
3. Do Na and K float on the surface of water or sink in it ? ....

▣ From the previous, we can deduce the general properties of alkali metals as follows.

Enrichment information (2)

Lithium is not kept under kerosene because it floats on the surface of it and it is immediately burns so it is kept in paraffin oil.

General properties of alkali metals :

1. They are mono-valent elements because their outermost shells contain (1) electron.
2. They tend to lose their valency electron forming positive ions that carries one positive charge.
3. They are chemically active elements so they are kept under kerosene or paraffin to prevent their reaction with the moist air.
4. Their chemical activity increases by the increase of atomic size. Cesium (Cs) is considered as the most active metal in general.
5. They are good conductors of heat and electricity.
6. Most of them have low density fig (5).

Reaction of K with H_2O
Figure (4)

Reaction of Na with H_2O
Figure (5)

Exercise (1)

From figure (6), mention the names of metals which sink and the metals which float on the surface of water. knowing that the density of water is 1 gm/cm^3

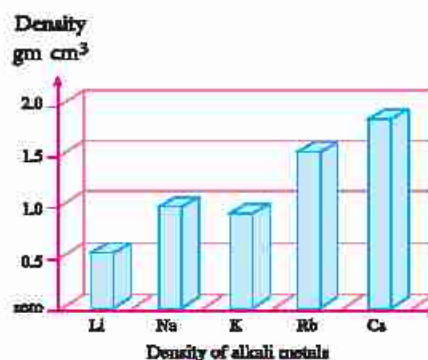



Figure (6)

2 Halogens group (7A)

Observe and think carefully about the position of halogens group in the periodic table **(Fig 7),** the group 7A lies on the right side of the periodic table, it is one of (p) block groups, the nonmetals of this group are called halogens **(Fig 8).**

Location of halogens group in the periodic table

Figure (7)

i.e salts formations, because they react with metals forming salts.

$$2K + Br_2 \longrightarrow 2KBr$$

Potassium Bromine ⟶ Potassium bromide

Halogen elements

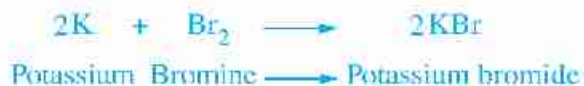



Figure (8)

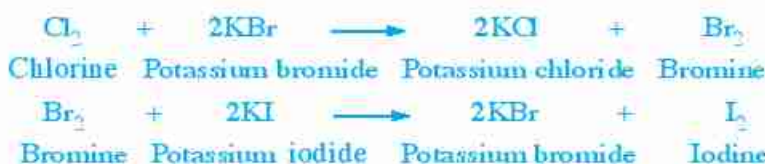
Enrichment information (4)

*Chlorine is used in the manufacture of correctors substance, it is a very volatile liquid, on using, it becomes dry quickly leaving a white substance on the paper surface.

Figure (9)

General properties of halogen elements :

1. They are mono-valent nonmetals ... Why ? ....
2. They exist as diatomic molecules F_2 , Cl_2 , ...
3. They are chemically active elements, so they do not exist individually in nature but they exist in chemical compounds, except astatine which is prepared artificially.
4. Each element in the group replaces the element below it in their solutions.

Cl_2	+	2KBr	⟶	2KCl	+	Br_2
Chlorine		Potassium bromide		Potassium chloride		Bromine
Br_2	+	2KI	⟶	2KBr	+	I_2
Bromine		Potassium iodide		Potassium bromide		Iodine

5. The physical state is graduated from the gaseous state (Flourine , Chlorine) to the liquid state (Bromine) to solid state (Iodine).

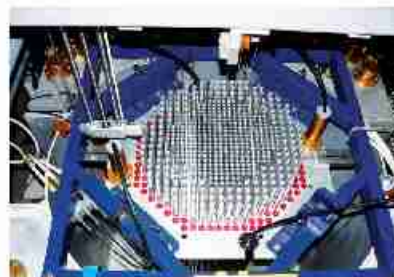
Exercise (2)

Write the equation of the reaction of Chlorine with sodium bromide.

....

The properties of elements and their uses

The uses of elements or their compounds depend on their properties. You have studied before some of traditional uses for known elements. Now you will know the uses of some elements in the modern techniques.

1. Sodium is used in liquid state as it is a good conductor of heat. It is used also in transferring heat from inside the nuclear reactor to outside to obtain vapour energy required to generate electricity (Fig 10).
2. Silicon slides are used in manufacturing of computers because they are semi-conductors which their conductivity of electricity depends on the temperature.
3. Liquefied nitrogen is used in preservation of the cornea of the eye because it has a low boiling point (-196 ºC.)
4. The radioactive cobalt 60 is used in food preservation because gamma rays which come out from it prevent the reproduction of microbial cells without an effect on human.

Core of nuclear reactor
Figure (10)

Electronic slide
Figure (11)

Enrichment information (5)

The Egyptian Scientist Dr. Moustafa El-Sayed got the highest American medal in science for his efforts in the Nano technology in 29th September 2008.

Dr. Moustafa El-Sayed

(Nano) applying this technology in using gold in the treatment of cancer disease.

Sterilization of meats by gamma rays
Figure (12)

Lesson summary

- Alkali metals are mono-valent
- In halogen group each element replaces the element which below it in its salt solution.

1 Choose the correct answer between brackets :

(1) .... is considered from halogen. (Sodium - Chlorine - Helium - Calcium)

(2) .... in its salt solution.

(Chlorine replaces bromine - Bromine replaces fluorine - Iodine replaces chlorine - Iodine replaces fluorine)

2 Give reasons for :

(1) Elements of group (1A) are known as alkali metal.

....

(2) Liquefied nitrogen is used in preservation of cornea of the eye.

....

3 Study the opposite figure which represents a section of the periodic table, then answer.

The letters in the table don't represent the actual symbols of the elements

(1) What is the symbols which indicates the :

(a) Inert gases. (b) Alkali metals.

(c) Halogens.

(2) What is the symbol which represents :

(a) The most active metal? (b) The most active nonmetal?

4 Mention one use for each of the following elements in modern technology :

(1) Liquid sodium ....

(2) Silicon ....

(3) Cobalt 60 ....

5 The opposite table explains the properties of three elements, mention the symbol which represents an element from :

(1) Alkali metal ....

(2) Halogen ....

Element symbol	Behaviour with water	Physical state	Electric conduction	Density (gm/cm^3)
X	dissolve	gas	bad conductor	0.003
Y	react	solid	good conductor	3.59
Z	react instantly	solid	good conductor	0.86

6 Creative Thinking:

Why lithium is not kept under kerosene but it is kept under paraffin oil?

By help of scientific refernces in your school library or peering at the internet to compare between alkali metals, halogen from point of : (atomic size, electronegativity - density - boiling point, melting point, atomic mass).

Lesson 4

Water

Lesson objectives

At the end of this lesson, The student should be able to :

1. Identify the bonds between its atoms and water molecules.
2. Identify the physical and chemical properties of water.
3. Explain the abnormality of physical properties of water.
4. Identify the electrolysis of water.
5. Explain why water is neutral.
6. Identify the water pollutants and their harms.
7. Identify how to keep water from pollution.
8. Appreciate the importance of water in our life.

Points of the lesson :

1. Structure of water.
2. Properties of water.
3. Water pollution.

Included issues

1. Decrease of water and wars because of it.
2. Rationalization of consuming of water.
3. Nile water pollution.
4. Citizenship and protecting of water from pollution.

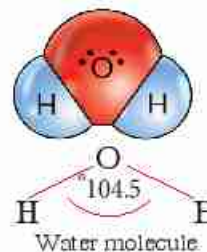
▣ According to your previous study, you know that water is necessary for the survival of all living organisms. Water is so important in agriculture, industry and personal uses.

Water structure :

You studied before that water :

Molecule is composed of the combination of one oxygen atom with two hydrogen atoms to form two single covalent bonds , the angle between them is 104.5° Fig (1).

Due to large electronegativity of oxygen compared with hydrogen, **a weak electrostatic** attraction is originated between water molecules which is called hydrogen bond. Fig (2).

Although these hydrogen bonds are weaker than the covalent bonds in the same molecules, they are considered to be the most important factors which are responsible for abnormality of water properties.

Water molecule

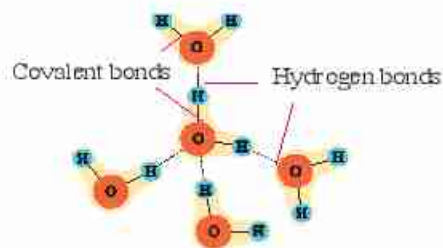



Figure (1)

Bonds between atoms and molecules in water

Figure (2)

Properties of water :

Water is a unique substance due to its existence in three states at the ordinary temperature fig. (3) and it has many physical and chemical properties like :-

Three states of H_2O

Figure (3)

1 Good polar solvent :

Participate with your co-operative group under the supervision of your teacher to do the following activity.

UNIT ONE

Activity (1) Identifying water as a polar solvent.

2 Identifying water as a polar solvent.

* Three beakers. * Table sugar. * Table salt.
* Food oil. * Stirring spoon.

Figure (4)

Steps :

1. Fill the beakers with equal amounts of water.
2. Put in the first beaker a spoon of table sugar, a spoon of table salt in the second beaker and oil drops in the third beaker fig. (4).
3. Stir the contents of the three beakers.

Observations :

- What are substances which dissolved in water?

....

- What are the tastes of the first solution and the second Solutions when you tast it with the tip of your tongue?

....

- What is the substance that does not dissolved in water?

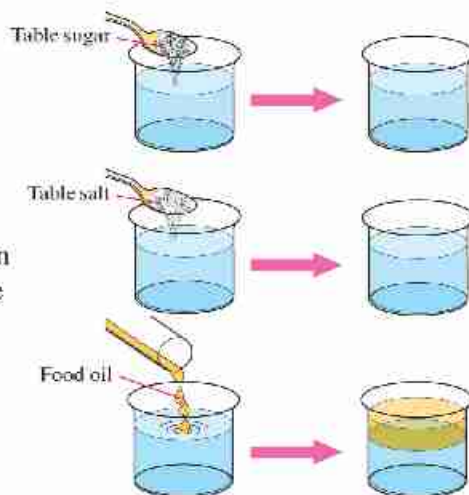
....

Conclusion :

1. Some substances dissolve in water, while others don't dissolve in it.
2. Water is a good polar solvent for most ionic compounds (as table salt) and for some covalent compounds (as sugar) which form hydrogen bonds with water.

3 High boiling and freezing points.

It was supposed that the boiling point of water is less than (100°C) and the freezing point is less than zero celsius. But the pure water at the normal atmospheric pressure boils at (100°C) and freezes at zero .... Why ?

High boiling and freezing points is due to the presence of hydrogen bonds between water molecules.

4 Water has low density when it freezes :

The density of water when it is in a solid state is lower than its density when it is in a liquid state because when the temperature decreases less than 4 °C, the water molecules are collected by hydrogen bonds forming. large-sized hexagonal crystals with many spaces between them fig. (5). So ice floats on the surface of water in the frozen zones which make marine organisms be still alive.

Hexa crystal of ice
Figure (5)

Self inquiry

Did you ask yourself about the reason of explosion of closed bottles which completely filled with water in the freezers?

Figure (6)

Enrichment information (2)

Density of salt water is higher than the density of fresh water so swimming in the sea is easier than swimming in the poles.

Search for and investigate why the Dead Sea in Palestine was called by that name, write a report and keep it in the portfolio.

Life application | Dissolving the ice of the freezer quickly.

Turn off fridge, put a hot water container in the freezer and close the fridge.

(you can use the hair dryer to direct a hot air current to ice and it melts quickly).

5 It has neutral effect on both of litmus papers

Participate with your classmate to do the following activity which explains the neutralization of water.

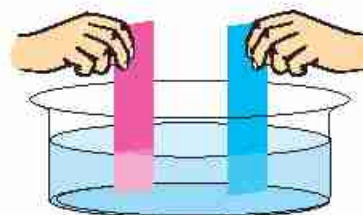
Activity (2) Discovering the neutralization of water

Figure (7)

Substance and tools

* Basin containing pure water.
* Two litmus papers (red - blue).

Steps :

What is the effect of putting both of litmus papers in pure water ? **(Fig. 7)**.

....

From the previous we conclude that

The pure water has a neutral effect on both of litmus papers (red and blue).

6 Electrolysis of water

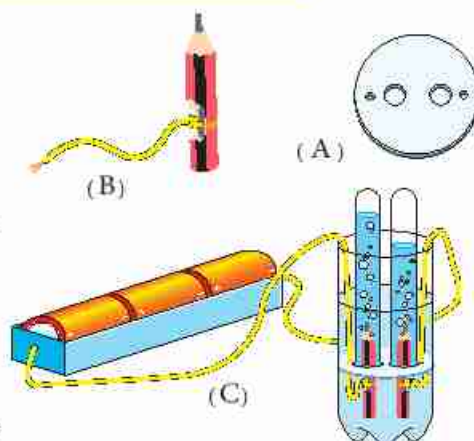
Activity (3) Investigating the process of electrolysis of water.

Substances and tools

* A round piece of foam plate.
* Sodium carbonate spoon.
* Empty plastic bottle.
* Battery 4.5 v.
* Two test tubes.
* Two pencils.
* Water.
* Two copper wires.
* Wax gun.

Figure (8)

Steps :

1. Cut the top of the plastic bottle and fill it to its middle with water and dissolve sodium carbonate in it.
2. Make a hole in the foam as in **fig. (8)**.

3 Remove carefully the wooden part of the two pencils until graphite appears, coil the copper wire around them as in fig. (8 B). Cover the bared part by wax gun.

4 Form the apparatus as in fig. (8 C) and close the circuit for 10 minutes.

Observations :

1 What is the ratio between two volumes of evolved gases over the negative pole (Cathode) and the positive pole (Anode)?

....

2 What is the effect of approaching a glowing splint to the gas formed at:

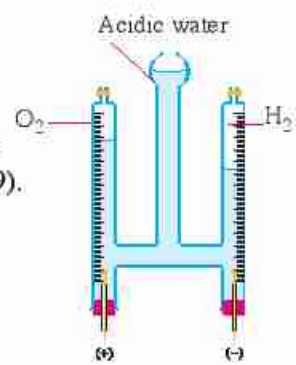
(1) Cathode ....

(2) Anode ....

Conclusion :

(1) Acidified water decomposes by electricity into two elements hydrogen and oxygen and the volume of hydrogen is twice the volume of oxygen.

$$\underset{\text{Water}}{2H_2O} \xrightarrow{\text{Electrolysis}} \underset{\text{Hydrogen}}{2H_2\uparrow} + \underset{\text{Oxygen}}{O_2\uparrow}$$

(2) Hydrogen evolves above the cathode, while oxygen evolves above the anode. Hoffman's voltameter is used in electrolysis of water fig. (9).

Hoffman voltameter apparatus
Figure (9)

Exercise (1)

On the electrolysis of a certain volume of acidified water by dilute sulphuric acid, the volume of evolved oxygen gas was 2 cm^3.
What is the volume of hydrogen gas evolved?

....

Water pollutants and their harms

- Environmental pollutants are divided generally into two kinds :

* Natural pollutants: Their sources are natural phenomena like occurence of volcanoes fig. (10), lightning accompanied by thunderstorms and death of living organisms.

* Artificial pollutants : Their sources are the different human activities.

Volcanic activity
Figure (10)

Exercise (2)

Mention many examples for water pollutants whose sources are human activities.

Water pollution is divided into (4) main parts

1 Biological pollution:

It is originated from mixing of human and animal wastes with water **fig (11)** and that causes many diseases such as Bilharzia, typhoid and that hepatitis.

Polluted Nile is due to animal stools
Figure (11)

2 Chemical pollution:

It is originated from discharging of factories wastes **fig (12)** and sewage in canals , rivers , and seas **fig (13)** the increase of some elements concentration causes great harms. Eating fish which contains high ratios of lead causes the death of brain cells, drinking water which contains high ratio of mercury leads to blindness. Arsenic increases the rate of infection by liver cancer.

Discharging of factories wastes in the canals
Figure (12)

3 Thermal pollution:

It is originated from the rise of temperature of some marine zones which use water for cooling the nuclear reactors which destroy the marine organisms found in them due to separation of dissolved oxygen in water **fig (14)**

Discharging sewage in canals
Figure (13)

4 Radiant pollution:

It is originated from leakage of radioactive substances from the nuclear reactors or dumping of the atomic wastes in seas and oceans.

Figure (14)

Protection of water from pollution :

- Many behaviours and percautions for protecting water from pollution in Egypt :

1. Getting rid of the phenomenon of discharging of sewage, factories wastes and dead animals in rivers or canals.
2. Development of water purification stations **(fig. 15)** and making periodic analysis to determine the rate of its validity for drinking.
3. Spreading environmental awareness among people about protection of water from pollution.
4. Disinfecting drinking water tanks above buildings periodically. **(fig. 16)**
5. Don't store the tap water in empty plastic bottles of mineral water because they react with chlorine gas which is used in disinfecting of water, so the rate of cancer infection increases.

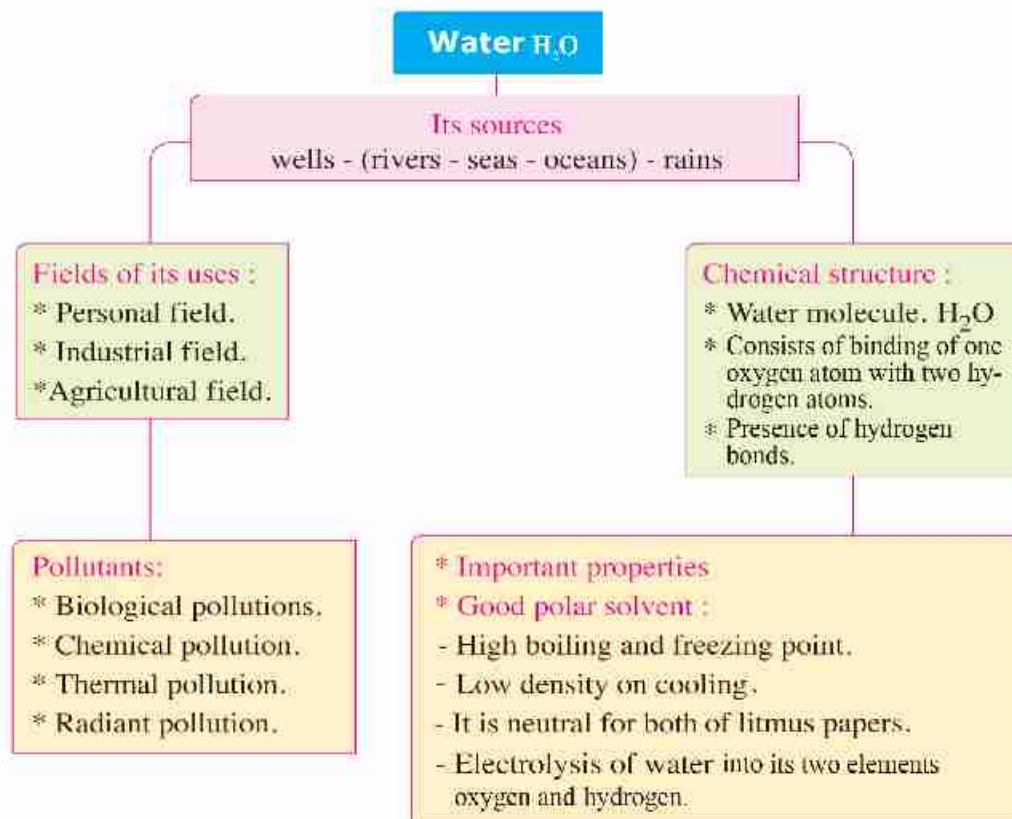
Water purification station
Figure (15)

Water tank
Figure (16)

A case for discussion **Water = Life**

Wars may break out due to fresh water, at the same time some people don't keep water resources well. Discuss with your classmates under the supervision of your teacher this case. Use these questions in the discussion.

1. Did you try the feeling of being thirsty?
2. What is your role and responsibility for the unfixed water tap at school or at home?
3. What do you feel about when you see victims of drought in Africa in the broadcast?
4. What should you do when you find a person throwing wasteing in the Nile?
5. What are your suggestions for keeping water of the Nile?

Lesson summary :

* Hydrogen bond is considered one of the most important factors that are responsible for the abnormality of water.
* Hoffman's voltameter apparatus is used in the electrolysis of water.

Questions on lesson 4

1 Choose the correct answer between brackets :

(1) All of the following are from the properties of water except .... (neutral on both litmus paper / polar compound / increase in volume on heating / analysis by heat into its elements)

(2) There are .... bonds between water molecules.
(hydrogen / covalent / ionic / metallic)

(3) A liquid boils at 100 °C, what is the other property which affirm it is a pure water ?
(Sugar dissolves in it / when it freezers , denstiy decreases / neutral on both litmus paper / it evaporates on heating)

2 Give reasons for :

(1) Presence of hydrogen bond between water molecules.

....

(2) Pure water doesn't affect litmus paper dye.

....

(3) Although sugar is a covalent compound , it dissolves in water.

....

3 What are the results of ?

(1) Water is polluted by the wastes of Man and animal.

....

(2) Storing water in plastic bottles of mineral water.

....

4 Choose from (B) what suits (A) column :

(A)	(B)
Probably harm	Responsible pollutant
(1) Death of brain cells.	(1) Lead.
(2) Cancer of liver.	(2) Sodium.
(3) Blindness.	(3) Mercury.
	(4) Arsenic.

5 The opposite figure illustrates Hoffman voltameter used in the electrolysis of water.

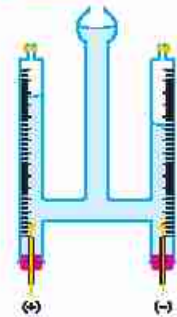
(1) Write the chemical equation which illustrates the chemical reaction.

....

(2) What is the volume of gas which burns with a pop sound when you approach a glowing splint to it if the volume of the other gas is 6 cm^3

....

(3) What is The name of The Collected gas at

- Cathode : ....
- Anode : ....

6 **Nuclear reactors cause thermal and radiant pollution :**
Explain this phrase.

....

7 **How do we keep water from pollution?**

....

8 **Creative thinking: What do you expect for the River Nile pollution after 50 years?**

....

Unit Revision

1 Choose:

(1) Scientist .... discovered the main energy levels in the atom.
(Bohr / Mendeleev / Mosely / Hoffman)

(2) Sodium oxide from .... oxides. (amphoteric / acidic / nonmetallic / basic)

(3) All the following elements from semimetals except for ....
(tellurium / silicon / boron / bromine)

(4) The strongest metal lies in the .... group. (2A / 1A / 1B / 7A)

2 What is meant by ?

(1) Chemical activity series? ....

(2) Water pollution? ....

(3) Semimetals? ....

3 How can you differentiate between magnesium oxide and sulphur oxide?

....

....

4 What is the importance of ?

(1) Liquefied nitrogen: ....

(2) Sodium in liquid state..

(3) Water : ....

5 Give reasons for :

(1) The use of radioactive Co 60 in food preservation.

....

(2) Elements of the same group have similar properties.

....

(3) The boiling point of water is high.

....

(4) Alkali metals are kept under kerosene in the lab.

....

6 What is the effect of the following on the water environment?

(1) Drainage of factories wastes in rivers and seas.

(2) Using of rivers and seas water as a renewable source for cooling the nuclear reactor.

(3) Mixing of animal and Man wastes with water.

Unit 2

The Atmosphere and protecting Planet Earth

Unit lessons :

Lesson 1 : The Atmospheric Layers

Lesson 2 : Erosion of Ozone Layer and Global warming

Learning Resources :

1. The air – stiv barkar Dar El-Farouk
2. The air – Dr. Abd El Baset Elgamal – Safer
3. Weather disasters – El Dar El hadesa For publishing and distribution
4. Climate Crisis – Nigel Hocks – Academia

Unit objectives

By the end of this lesson, the student must be able to:

1. Know the concept of atmospheric pressure and layers of atmospheric envelope.
2. Interpret the change of atmospheric pressure with changing height above sea level.
3. Appreciate the importance of instrumets that measure atmospheric pressure.
4. Describe the characteristics of atmospheric layers.
5. Compare among the characteristics of atmospheric layers.
6. Conclude the importance of each layer of atmosphere.
7. Recognize the importance of studying each layer of the atmosphere.
8. Appreciate the role of scientist to reach devices measuring atmospheric pressure.
9. Know the composition of Ozone gas.
10. Conclude the steps of Ozone formation.
11. Aware of the importance of the Ozone layer of the human and living organisms.
12. Desribe hurmful effects for pollutants of Ozone layer.
13. Determine ways te protect Ozone layer.
14. Follow up the procedures and solutions, to the problems of ozone depletion.
15. Describe the global warming phenomenon and greenhouse effect.
16. Identify greenhouse gases.
17. Explain increase the temperature of atmospheric envelope of earth.
18. Determine the negative effects resulted from the rising temperature of the earth's atmosphere.
19. Follow up the percedures and solution to problems of global warming phenomenon.
20. Appreciate greatress of God in providing the atmosphere and air for living organisms.

Lesson 1

The Atmospheric Layers

Lesson objectives :

By the end of this lesson, the student must be able to:

1. Know the concept of atmospheric pressure.
2. Interpret the change of atmospheric pressure with changing height above sea level.
3. Understand the change of atmospheric pressure with changing height above sea level.
4. Appreciate the importance of instruments that measure atmospheric pressure.
5. Mention the importance of altimeter.
6. Know atmospheric layers.
7. Mention the characteristics of atmospheric layers.
8. Compare among the characteristics of atmospheric layers.
9. Determine the importance of each layer of the atmosphere.

Lesson subjects :

1. Atmospheric pressure.
2. Change of atmospheric pressure with height above sea level.
3. Atmospheric layers.

Included issues :

1. Instability of weather.
2. Laws and rules of the internet communication.

Atmospheric pressure

The Earth is surrounded by a gas envelope that rotates with it about its axis, and extends 1000 km above sea level. It is known as atmosphere.
The weight of air column of an atmospheric height on a unit area is called air pressure or atmospheric pressure.
It is measured in a unit called a bar. The bar equals 1000 millibar (mbar).

Enrichment Information (1)

* The internal pressure of human body equals the atmospheric pressure.
* How does climbing heights or diving deep in ocean affect eardrum?

Normal atmospheric pressure at sea level equals 1013.25 millibar.

Change of atmospheric pressure with change in height above sea level :

Share your cooperative group in performing the following activity:

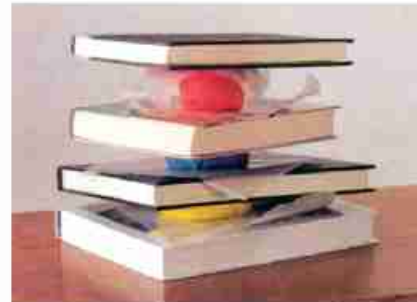
Proving how atmospheric pressure changes with changing height above sea level.

Materials and tools:

- 4 big books.
- 3 pieces of modelling clay with different colors.
- 6 plastic sheets.

Figure (1)

Procedure:

1. Form the modelling clay into 3 identical balls.
2. Put clay balls between the plastic sheets and the books.

Observations :

1. Do the balls' shape change? Why? ....
2. Which ball did change more? Why? ....
3. Which ball did change less? Why? ....

As the weight (pressure) of books increases due to their number (height), the change in balls' shape increases.
Likewise, atmospheric pressure increases as the height of air column increases.
It was found that :
50% of atmosphere mass occurs in the area between sea level and 3 km high. Meanwhile, **90% of its mass is concentrated in the first 16 km above sea level.**

- What is the effect of the height decrease of an atmospheric air column on its weight?

  ....

  ....

- What is the effect of rising up above sea level on the air density?

  ....

  ....

Air density at a top of mountains
Figure (2)

Exercise (1)

In airplanes, an altimeter is used to determine the elevation of the navigation based on the atmospheric pressure at this level.

Choose the values of atmospheric pressure that suite the elevations above sea level (Table 1).

Altimeter in aeroplanes
Figure (3)

Table 1

Elevations above sea level (km)	Atmospheric pressure (millibar)
(1) 3 km	203 m bar
(2) 6 km	731 m bar
(3) 9 km	323 m bar
(4) 12 km	503 m bar

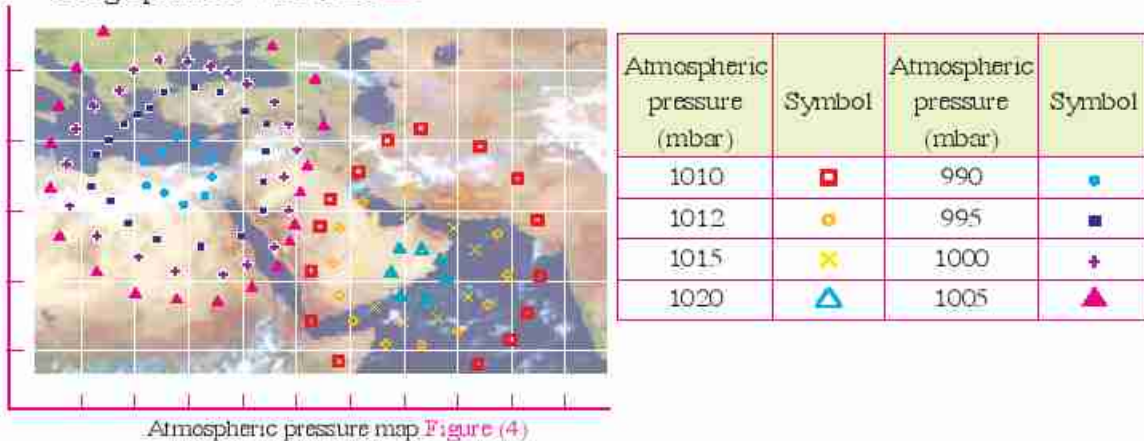
Enrichment Information (2)

The greatest atmospheric pressure that ever recorded so far on the earth's surface was in January 1968 in Siberia when it reached 1080 millibar. On the other hand, the lowest pressure was 870 millibar where it is recorded in the eye of the tropical hurricane "typhoon" in 1979.

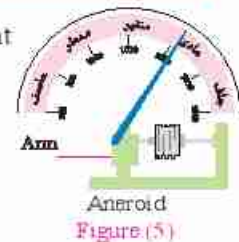
Exercise (2)

Use a curved line to connect the points indicating equal pressure (Isobar) (fig. (4) to make a surface pressure map. Then mark the center of low pressure with letter L and the center of high pressure with letter H.

Atmospheric pressure map Figure (4)

Atmospheric pressure (mbar)	Symbol	Atmospheric pressure (mbar)	Symbol
1010	◘	990	●
1012	○	995	■
1015	×	1000	✚
1020	△	1005	▲

Real life application | Barometer to determine today's weather

The possible day's weather can be estimated directly with an instrument known as Aneroid (fig. 5). It is a type of barometers, which is used to measure atmospheric pressure.

Aneroid
Figure (5)

Layers of atmospheric envelope

Atmospheric envelope is divided into several layers according to the changes in the atmospheric pressure and temperature they are illustrated by the following activity.

Activity (2) Recognizing atmospheric layers:

Study and investigate figure (6) and write down your observatiosn after answering the following questions:

(1) How many layers are in the atmosphere?

....

(2) Name these layers, starting from sea level.

....

(3) What is the name of the surface area at which the temperature is constant between:

(a) First and second layers?

....

(b) Second and third layers?

....

(c) Third and fourth layers? ....

Atmospheric layers
figure (6)

First layer : Troposphere

Troposphere is the first layer of the atmosphere. It means the disturbed layer where most of the weather changes occur in this layer.

To know the characteristics of the troposphere, share your working group in performing the following activity:

Activity (3) Concluding the characteristics of the troposphere.

Investigate figure (7) carefully with the help of your group and conclude the characteristics of the troposphere by answering the following questions:

(1) What is the approximate thickness of the troposphere layer? ....

(2) What would happen to the temperature as going up in the atmosphere?

....

(3) What is the value of the atmospheric pressure at the end of the layer? ....

(4)What is the value of the temperature at the end of the layer? ....

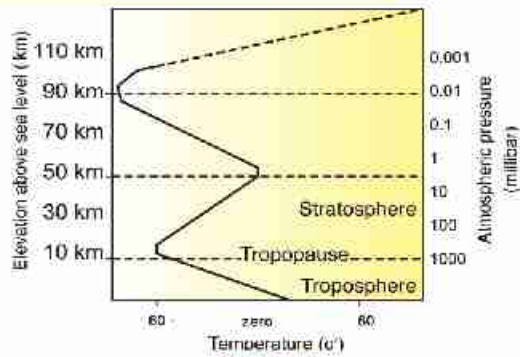



Figure (7)

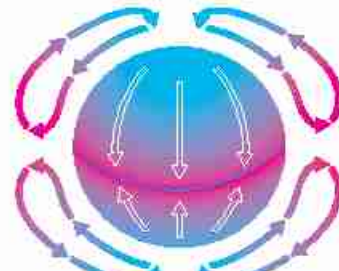
Enrichment information (3)

Troposphere thickness is 13 km. It is an average thickness as it is about 8 km above poles and 18 km at the equator.

Characteristics and importance of the troposphere:

1. It extends 13 km above sea level to the tropopause.
2. As we go up, the temperature decreases by a rate of 6.5 °C per 1 km until it reaches the lowest value of about (-60 °C) at tropopause.
3. Atmospheric pressures decreases as we go higher, where it reaches about 100 millibar nearly.
4. It contains about 75% of the atmosphere mass. This explains why all atmospheric phenomena like rain, wind, clouds .... etc (fig.8) that forms the weather conditions, and consequently up the climate, occurs in this layer and affects the activities of living organisms.

Clouds and winds
Figure (8)

5. It contains about 99% of the atmospheric water vapour, which organizes the earth's temperature.
6. **The air movement in this layer is vertical (fig. 9) as the** warm air currents go up and the cold currents go down.

Air currents
Figure (9)

Self inquiry

Have you ever asked about the characteristics of the hieghts and low areas, relative to sea level, in Egypt ? Where they are?

Communication

By the guide of your teacher, discuss with your classmates, the advantages and disadvantages of living in these areas?

Exercise (3)

If the temperature at the base of mount Everest is 20.6 °C, how much is the temperature at its top if the mountain height is 8862 m?

Solution:

Height (km) = ……………………………………………………………………………………

The decrease in temperature = height (Km) X 6.5 = ……………………………………………

Temperature at the top = temperature at the base – decrease in temperature ……………………

Second layer: Stratosphere

Stratosphere is the second atmospheric layer, which is also called ozone atmosphere Why?

Activity (4) Concluding the characteristics of the Stratosphere.

Investigate figure (10) carefully with the help of your group and conclude the characteristics of the stratosphere by answering the following questions :

1. What is the name of the two areas where between them stratosphere is located?

……………………………………………………………

……………………………………………………………

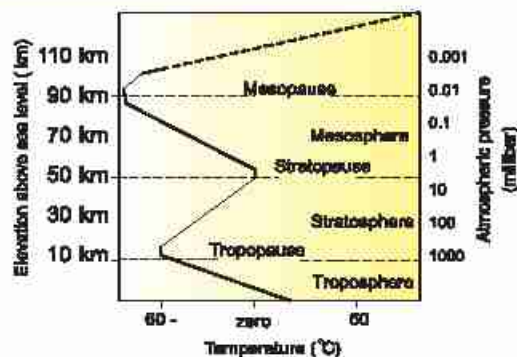



Figure (10)

2. What is the thickness of the stratosphere? ....

3. What would happen to the temperature if going higher?...

4. What is the atmospheric pressure value at the end of the layer? ....

Characteristics and importance of the stratosphere:

1. It extends from tropopause (13 km above sea level) to the stratopause (50 km) with thickness of 37 km.

2. At the lower part, the temperature is constant and measure (– 60° C), then increases gradually until it reaches 0° C at the end of the layer. This is due to the absorption of ultraviolet radiation (emitted from The Sun) by the ozone layer that is present in the upper part of the layer.

3. The atmospheric pressure decreases on going higher where it reaches the smallest value (0.001 of the normal pressure at sea level) at the end of the layer.

4. It contains most of the atmospheric ozone which is concentrated between 20 - 40 km above sea level.

5. The lower part does not contain clouds or suffer from any weather disturbances. The air moves in this part horizontally, making it suitable for flying planes (fig. 11)

Flying in the stratosphere
Figure (11)

Third layer: Mesosphere

– Mesosphere is the third atmospheric layer.

– It means the middle layer. It is the coldest layer.

Enrichment Information (4)

Although meteors burn in the mesosphere, spaceships don't burn during passing through it as they have a conical front that disperses heat and tails made of an insulated material.

Characteristics and importance of the mesosphere:

1. It is extended from the stratopause (50 km above sea level) to the mesopause (85 km) with thickness of about 35 km.

2. Temperature decreases with height rate until reaches (– 90° C) at its end.

3. This layer is much vacuumed as it contains only a limited amount of helium and hydrogen gases.

4. Meteors are formed in this layer due to friction with air molecules (fig. 12)

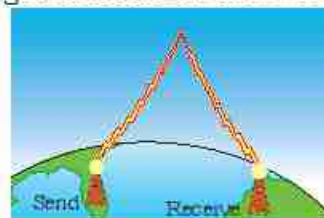
Formation of meteors in the mesosphere
Figure (12)

Fourth layer: Thermosphere

Thermosphere is the fourth atmospheric layer. It means the heated layer as it is the hottest layer of the atmosphere.

Characteristics and importance of the thermosphere :

1. It extends from the mesopause to 675 km above sea level with a thickness of about 590 km.
2. Temperatures increase rapidly with going higher until it reaches about 1200° C.
3. Its upper part contains charged ions. The distribution of the charged ions extends until 700 km above sea level; in a part known as ionosphere.

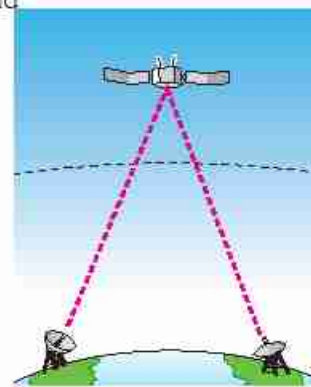
- Ionosphere plays an important role in wireless communication and broadcasting as it reflects radio waves that are transmitted by communication centers and radio stations (fig. 13).
- Ionosphere is surrounded by two magnetic belts known as Van Allen Belts (fig. 14). These two belts play an important role in dispersing the harmful charged cosmic radiation away from the Earth. In the same time, they cause the Aurora phenomenon, which appears as brightly coloured light curtains at both the North and South poles of the Earth (fig. 15).

Reflection of radio waves from the ionosphere
Figure (13)

Aurora phenomenon Figure (15)

Van Allen Belts
Figure (14)

The atmosphere is inserted into the outer space via an area known as the Exosphere. This is the area where satellites float around the Earth (fig. 16) and transmit weather condition information and TV prvograms.

Enrichment Information (5)

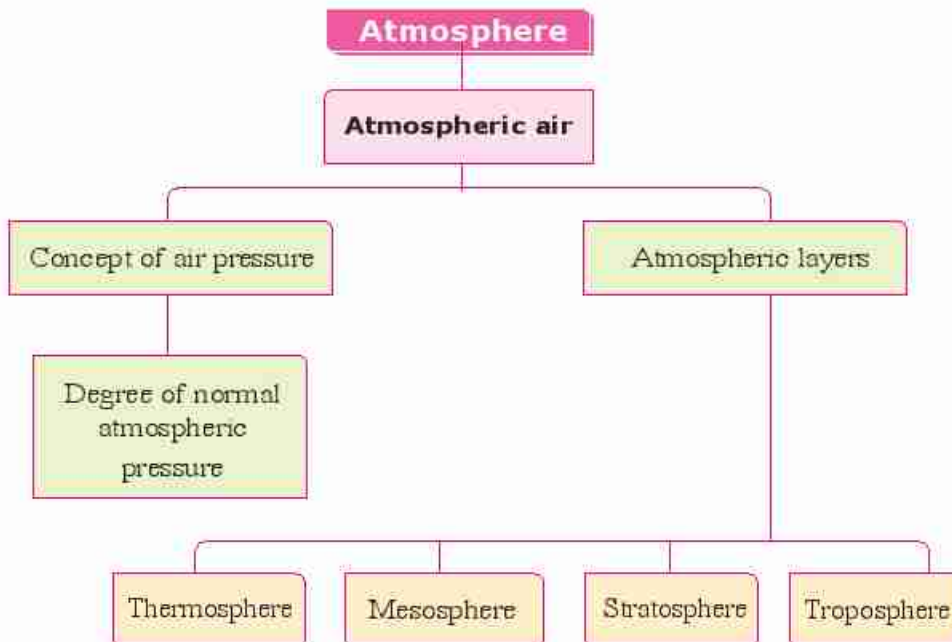
* The Egyptian Satellite (Nile sat) transmits a number of different educational channels that you can watch on digital space channels.
* Record the dates of broadcasting of the educational material you study on the educational channels during a week and distribute them among your classmates to benefit from them.

Role of satellites in wireless communication
Figure (16)

A case for Discussion **Space channels**

Space channels use satellites to transmit media and commercial materials. Some of them is useful and acceptable. Others contradict morals and religion principles.

Guided by your teacher, discuss this issue with your classmates. Use the following questions as part of a discussion subject:

- What are the channels that you watch? Why?
- What are the interesting programs that you watch in these channels?
- Does one of your friends watch channels that transmit obscene material?
- How do you deal with such channels in a civilized manner?

Lesson summary

- Atmospheric pressure is the weight of air column on a unit area.
- Normal atmospheric pressure (at sea level) equals 1013.25 millibar.
- Temperature in troposphere decreases on getting higher, the rate of decrease is 6.5° C/1km.
- The ionosphere is surrounded by Van Allen Belts which are responsible for dissipating harmful cosmic rays away from the Earth.

Revision of lesson 1

1 Choose the correct answer from statements between brackets:

a. Normal atmospheric pressure equals .... millibar.
(1013.25 / 76 / 1.013 / 760)

b. .... is located between stratosphere and mesosphere.
(Tropopause / Stratopause / Mesopause / Thermopause)

c. Meteors burn in ....
(mesosphere / ionosphere / exosphere / stratosphere)

2 Give reasons for :

a. The lower part of the stratosphere is suitable for flying airplanes.
....

b. Ionosphere is important for radio stations.
....

3 Mention the importance of each of the following:

a. Van Allen's Belts ....

b. Altimeter ....

c. Satellites ....

4 Arrange the atmospheric layers according to the Value of The atmospheric Pressure.

....

5 What is meant by each of the following ?

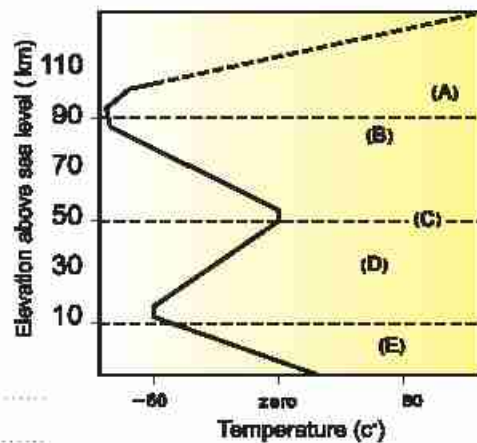
a. Atmospheric pressure.
....

b. The aurora phenomenon.
....

6 The opposite figure exhibits the temperature changes in the atmospheric layers :

(1) Replace the letters on the drawing with suitable labels ....
....

(2) Which layer is :
The highest in temperature ....
The least in temperature ....

Elevation above sea level (km)
110
90
70
50
30
10
(A)
(B)
(C)
(D)
(E)
−60
zero
60
Temperature (c°)

In less than 10 lines, write an editorial about the effect of getting higher above sea level on the life of Man; using magazines, periodicals, encyclopedias, and school library or internet sites.

Lesson 2

Erosion of Ozone Layer and Global Warming

Lesson objectives :

By the end of this lesson, the student must be able to :

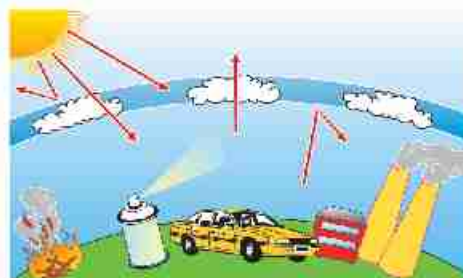
1. Know the composition of Ozone gas.
2. Conclude the steps of ozone formation.
3. Appreciate the importance of Ozone Layer.
4. Describe the harmful effects of short- and medium-wave length ultraviolet radiation on the Ozone Layer.
5. Mention the pollutants of Ozone Layer.
6. Determine ways to protect Ozone Layer.
7. Describe the global warming phenomenon and the greenhouse effect.
8. Identify greenhouse gases.
9. Interpret the rising temperature of the earth's atmosphere.
10. Determine the negative effects resulted from the rising temperature of the earth's atmosphere.
11. Follow up the procedures and solutions to the problems of erosion of the ozone layer and global warming.

Main subjects :

1. Composition of Ozone gas.
2. Importance of Ozone Layer.
3. Erosion of the Ozone layer (ozone hole).
4. Pollutants of Ozone Layer and their effects.
5. Protecting the Ozone Layer.
6. Greenhouse effect and global warming phenomena.
7. Negative effects due to global warming.

Included cases :

1. Erosion of the Ozone Layer (ozone hole).
2. Impacts of science and technology on the society.
3. Greenhouse effect phenomenon.
4. World coalition.
5. Managing energy consumption.

Since the mid 20th century, erosion of the Ozone Layer depletion and global warming phenomena have been the most serious threats.

The effects of pollutants on the atmosphere
Fig. (1)

First Erosion of the Ozone Layer phenomenon

Fig. (2)

Composition of ozone gas

- You may ask: why is Ozone layer formed in the stratosphere?

What is ozone gas? How is it formed?

Activity (1) Concluding how ozone gas forms

Observe and investigate with your classmates the following figures, then conclude how ozone gas is formed.

1. From the following, select a suitable comment for each shape and write it down under it:

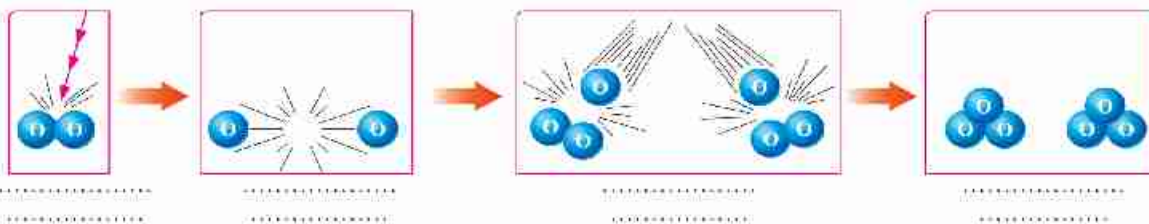



Fig. (3)

- Absorption of ultraviolet radiation by gas molecules.
- Combining a free atom with a molecule of the same gas.
- Formation of Ozone molecule.
- Break down the bond in the gas molecule and formation of two free atoms.

2. What is the gas that its molecules absorb the ultraviolet rays? ……………………………
3. What is the symbole of the Ozone molecule?…………………………………………………

Based on the previous, ozone gas is formed in two steps:

- Breaking down the bond of the oxygen molecule O_2 when it absorbs the ultraviolet radiation (UV), producing two free active oxygen atoms 2O

$$O_2 \xrightarrow{UV} O + O$$

- Each free oxygen atom combines with an oxygen molecule to produce an ozone molecule (fig. 4)

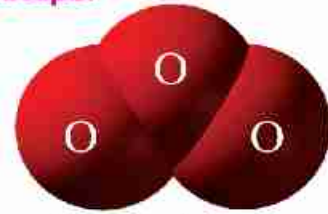
$$O + O_2 \longrightarrow O_3$$

Ozone molecule O_3

Fig. (4)

Enrichment information and activity (1)

* Ozone gas has a faint blue color and of distinct smell. This can be observed near instruments that contain electric discharge pipes as in the cases of light photographic machines and TV sets.
* Mention instruments produce ozone gas when they are set to work.

Ozone layer is formed in the stratosphere, and is located at a height between 20:40 km above sea level. Ozone layer is the first atmospheric layer that meets the ultraviolet radiation coming from the Sun. This layer contains a suitable amount of oxygen gas.

Importance of Ozone Layer

Investigate figure (5) and determine the type of ultraviolet radiation that does not penetrate Ozone Layer:

- with ratio 100% ....
- with ratio 95% ....

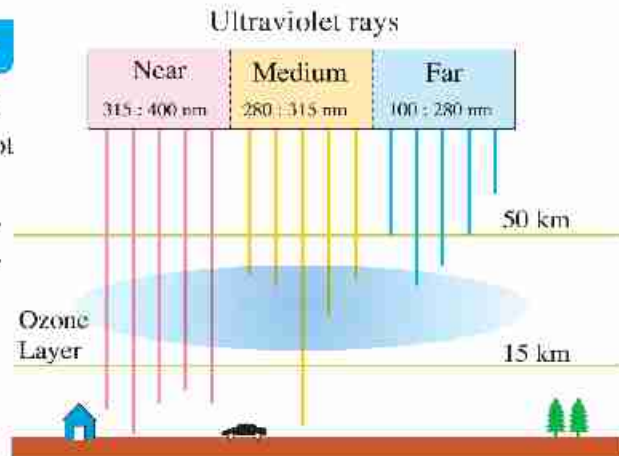
Nanometer = 1×10^{-9} meter

Importance of Ozone Layer

Fig. (5)

UNIT TWO

Ozone layer does not allow penetration of all far and most of medium ultraviolet radiations, which have very harmful effects. That is why Ozone is said to act as a protective shield for living organisms against the harmful chemical effects of the ultraviolet radiation.

Enrichment information (2)

Ultraviolet radiations, of wavelength close to the visible light penetrates the atmosphere and reaches the earth's surface, where it helps in producing Vitamin D in the bodies of the newly born babies.

Erosion of the Ozone layer

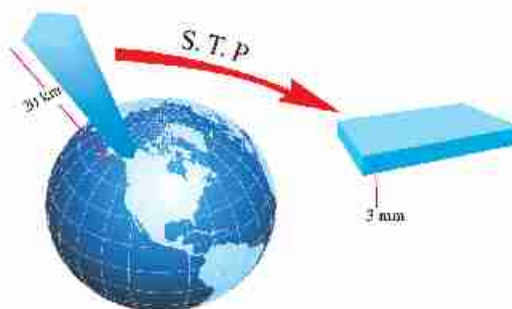
Temperature and atmospheric pressure at Ozone layer differ from those at earth's surface. The English Scientist Dobson postulated that the thickness of the Ozone Layer is 3 mm only if it were under the normal pressure and 0° C temperature; a condition known as STP or standard temperature and pressure (fig. 6) Accordingly, he assumed that the natural amount of ozone equals 300 Dobson units.

The thickness of ozone layer under S.T.P

Fig. (6)

Exercise (1)

What is the ratio of erosion of the Ozone layer in an area if you know that the degree of its Ozone is 150 Dobson?

....

Since 1978, scientists have noticed that there was erosion of the Ozone layer above the South Pole; phenomenon known as Ozone Hole, that increases in September each year –Why? Its rate changes from year to year (fig. 7)

Enrichment information (3)

In fall, 2001 erosion of the Ozone layer reached 20×10^6 km^2, which equals twenty times the area of Egypt. In autumn, 2008 it reached 27×10^6 km^2; an area is larger than North America.

Exercise (2)

Use Dobson units at the base of figure (7) which represents the Ozone condition in fall, 2008; to show what each of the following indicates:

Green color ....

Violet color ....

Ozone degree (Dobson units)

Depletion of Ozone Layer

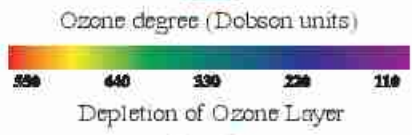
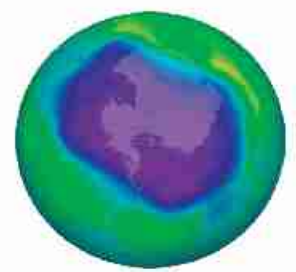



Fig. (7)

Pollutants of Ozone Layer

The most dangerous pollutants are:

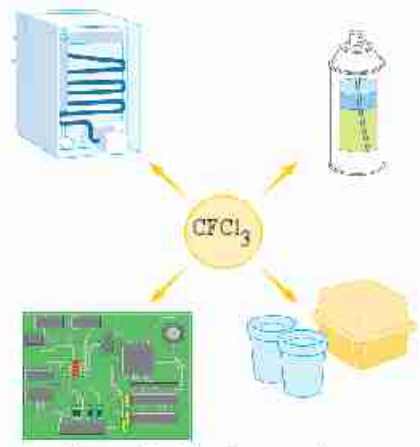
1. Chlorofluorocarbon compounds (CFCs): They are commercially known as Freon, which is used as a cooling material in air conditioning sets, as propellant in aerosols or as inflating material in making foam backing or as a solvent for cleaning electric circuits cards (Fig 8).
2. Methyl bromide: that is used as an insecticide to preserve stored agricultural crops.
3. Halons: that are used in fire extinguishers.
4. Nitrogen oxides: that result from the burning fuel of ultrasound airplanes (Concord).

Uses of chlorofluorocarbon compounds

Fig. (8)

Use The internet or any availble Source To search about the Egyptian role in the international environmental affairs and the efforts of Dr. Mostafa Kamal Tolba in this field.

UNIT TWO

Protecting the Ozone Layer

- Use of chlorofluorocarbon compounds must be reduced and find safer alternatives.
- Stop producing the ultrasound concord planes as their exhausts affect the Ozone.

Second Global Warming

Researches of the IPCC (The Intergovernmental Panel on Climate Change), that follow UN, showed that there is an increase in the average temperature of the Earth's near-surface air, a phenomenon known as Global warming which is caused by the greenhouse effect What can you conclude from **the figure below ?**

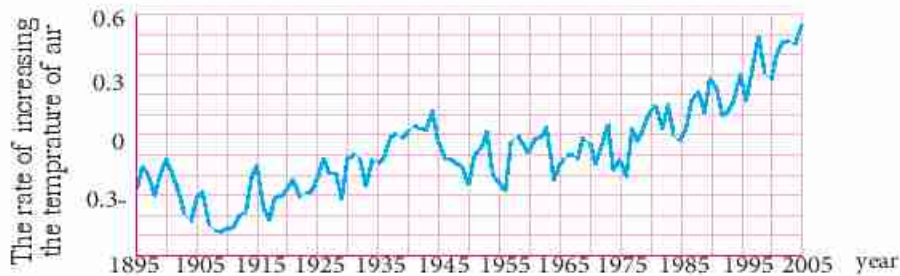



Figure (9) Rising of planet Earth temperature

Greenhouse effect

Share your group in performing the following activity to know the greenhouse effect phenomenon.

Activity (2) Greenhouse effect

Tools :

- 2 empty soda bottles
- 2 thermometers
- Sodium bicarbonate powder
- Vinegar
- Water.

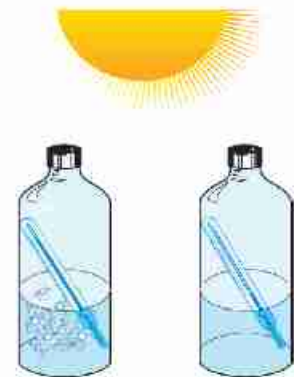
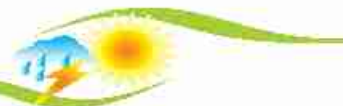



Figure (10)

Procedures:

1. Pour some water in the first bottle and a same amount of vinegar in the second.
2. Insert a thermometer in each bottle.
3. Put some sodium bicarbonate powder in one bottle and close it immediately to keep CO_2 gas trapped.
4. Put both bottles in a sunny place **fig. (10)**.

Observation :

Which bottle shows higher increase in temperature after 10 minutes?

....

Conclusion :

Increase of the concentration of CO_2 gas contributed to higher temperature.

- The same is happening as the temperature of planet Earth has been increasing since 1935 due to the greenhouse gases in the atmosphere. These gases are produced by fossil fuel burning **fig. (11)** , cutting trees and forest fire.

Products of burning fossil fuel

Figure (11)

The most important greenhouse gases

- Carbondioxidegas CO_2
- Chlorofluorocarbons CFCs compounds
- Methane gas CH_4
- Nitrous oxide N_2O
- Water vapour H_2O

Enrichment information (7)

Greenhouse gases are considered a blessing which can be changed into a catastrophe without those gases the temperature would have decreased to - 18°C. The increase of its Concentration in the atmosphere will lead to environmental disasters.

Interpretation of the greenhouse phenomenon :

When the concentration of greenhouse gases increases in the atmosphere, it plays the role of glass in the greenhouse (Fig. 12) as it permits the visible light and short-waved radiation from the Sun to pass and be absorbed by Earth and its components which reemit the radiation back in the form of infrared radiation. Infrared radiation cannot penetrate the atmosphere as it has a long wave-length. So it is kept trapped in the troposphere causing the rise of planet Earth temperature, a phenomenon known as greenhouse effect (Fig. 13).

Greenhouse
Figure (12)

Greenhouse phenomenon
Figure (13)

The negative effects of Global Warming Phenomenon

One of the most dangerous effects is graded to the phenomenon of raising the temperature of the Earth planet.

1 Melting of the ice and snow of both South and North Poles:

Melting of polar ice would increase sea level in seas and oceans figure (14) which represents a threat of the disappearance of the coastal areas and that would lead to the extinction of some polar animals like the polar bear (Fig. 15) and seals (Fig. 16).

Melting of snow masses
Figure (14)

Polar bear
Figure (15)

Seals
Figure (16)

2 Severe climatic changes

Among these features is the repeated occurrence of tropical hurricanes (Fig. 17) such as hurricane Katrina in 2005, destroying floods (Fig. 18), drought waves (Fig. 19) and forest fires.

Tropical hurricane

Figure (17)

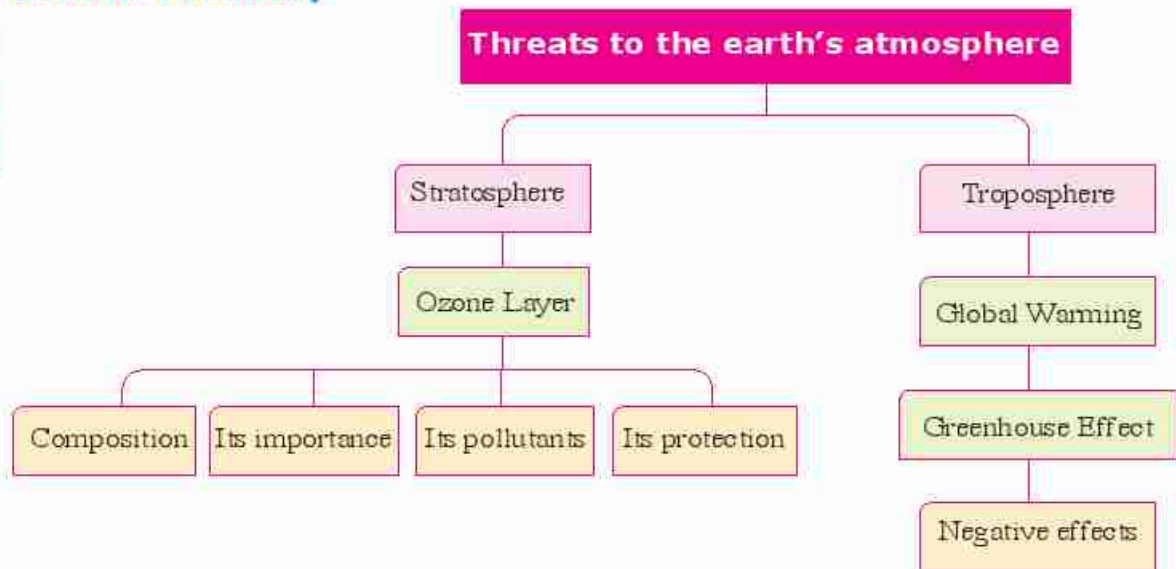
Flood

Figure (18)

Drought wave

Figure (19)

Use The internet or any availble Source To search about saving the used enewrgy at homes, then discuss it with your teacger.

Lesson summary

- Ozone molecule O_3 is formed by combining one free oxygen atom with one oxygen molecule.
- Ultraviolet radiation, far and medium types have harmful effects on the life of living organisms.
- Chlorofluorocarbon compounds are the most dangerous Ozone Layer pollutants.
- Increasing CO_2 concentration in the atmosphere produces the global warming phenomenon.

Revision of lesson (2)

1 Replace each of the following statements by suitable scientific term:

a) A molecule is formed from combining an atom of an element to a molecule of the same element. (……………………)

b) Continuous increase of the average temperature of the air near the surface of the Earth. (……………………)

2 Choose the correct answer from those between brackets:

a) Ozone Layer is measured by a unit called ……………..

(Km / Dobson / nm / mm^3)

b) All are greenhouse gases except ……………….

(CO_2 / O_2 / N_2O / CH_4)

3 Give reasons for :

a) Formation of Ozone Layer in the stratosphere.

……………………………………………………………………………………………………

b) Stop Producing concord airplanes.

……………………………………………………………………………………………………

4 Write short note about the negative results of global warming.

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

……………………………………………………………………………………………………

Unit Revision

1 Replace each of the following statements by a suitable scientific term:

1) The boundary separating between stratosphere and mesosphere where temperature is rather constant. (............)
2) Charged layer reflects radio waves. (............)
3) One of the atmosphere components that its ratio increased in recent years to reach about 0.038%. (............)
4) A type of ultraviolet radiation that is absorbed completely (100%) in the Ozone Layer. (............)

2 Complete the following phrases:

1) The highest temperature layer in the atmosphere is .... and the least temperature one is ....
2) Most of weather features occur in .... layer whereas satellites rotate through the .... layer.
3) Ultraviolet radiation has a .... effect, and the infrared radiation has a .... effect.
4) Among the pollutants of the Ozone Layer are .... compounds that are used in air conditioning sets and .... compounds that are used in fire extinguishers.

3 Illustrate with formulas only the role of ultraviolet radiation in the formation of Ozone gas.

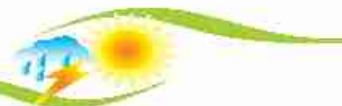
....

....

4 An aeroplane captain announced that the atmospheric pressure outside the aeroplane is 90 millibar. In which layer of the atmosphere was the plane flying? Why?

....

....

5 Compare between mesosphere and thermosphere in terms of temperature, importance, and air pressure.

....

....

....

Unit 3

Fossils and Protecting Species from Extinction

Lessons of the unit

Lesson 1 : Fossils

Lesson 2 : Extinction

Sources of knowledge and learning

• Scientific books and encyclopedias

1 The Rocks - Nataly	Family library
2 Disasters - Nedhalay	Dar El Farouk
3 Guinnes Q & A (The world of dinosaurs)	Family library
4 Forests	Lebanon library publishers

Unit objectives

By the end of this unit, the student should be able to :

1. Recognize the concept of fossil.
2. Give different examples of fossils.
3. Infer the types of fossils.
4. Explain the ways of fossils formation.
5. Design a cast of a candle.
6. Design models of cast and mold.
7. Compare between types of fossils.
8. Mention the importance of studying fossils.
9. Calculate the age range of some fossils.
10. Appreciate the importance of the discovery of fossils in the service of man, environment and society.
11. Establish a vision to take responsibility and take personal decisions to protect fossils.
12. Collect data and information and expressed his opinion in the protection of **fossils and their scientific and social importance.**
13. Use research skills and inquiry in the study of fossils.
14. **Define the concept of extinction.**
15. Use fossils to indicate extinction of some types of organisms.
16. Conclude the factors that cause extinction of same types of living organisms.
17. Give examples of extinct and endangered species.
18. Understand the effect of extinction on ecological equilibrium.
19. Suggest new solutions to protect living organisms from extinction.
20. Deal gently with the organisms and in a civilized manner with the environment.
21. Act consciously with the environment and appreciate the importance of normal life.
22. Appreciate the role of scientists in protecting living organisms from extinction.
23. Use life skills in the study of extinction and protection of living organisms from extinction.
24. **Write a scientific report on the causes of extinction of some organisms.**
25. Continue and express their views and discuss with his colleagues and the teacher about ways to protect living organisms from extinction.
26. Appreciate the greatness of God in the creation of living organisms.

Lesson 1

Fossils

Lesson objectives:

By the end of this lesson, the student should be able to:

1. Define the concept of fossils.
2. Give different examples of fossils.
3. Show the types of fossils.
4. Determine the ways of fossils formation.
5. Design a cast of a candle.
6. Design models of cast and mold.
7. Compare between mold and trace.
8. Give examples of complete body fossils.
9. Conclude the concept of petrif ication and petrified fossils.
10. Explain how the petrified woods are formed.
11. Mention the importance of studying fossils.
12. Calculate the age range of some fossils.
13. Appreciate the importance of the discovery of fossils.
14. Take personal decisions to protect fossils.

Points of the lesson:

1. Concept of fossil.
2. Types of fossils and their formation.
3. Importance of fossils.

Included issues :

The scientific, technological and social importance of fossils.

Fossils ... an exciting world ... a story told by sedemintary rocks .. tells us about the deep past , million years ago even before the creation of man on Earth.

Fossil concept :

Activity (1) Determining the concept of fossil

Organize a trip with your classmates to visit the Geological Museum at the River Nile bank in Zahraa El Maady and observe the fossils presnet in it :

Traces of worms' tunnels
Figure (2)

Dinosaur foot prin
Figure (1)

Observations :

What is the name you expect to reflect the residues or traces that indicate ?

The activity of the living organism during its life?

....

Remains of dinosaur's skull
Figure (4)

Remains of shark's teeth
Figure (3)

Remains of a living organism after death ? ......

....

Conclusion :

Traces and remains of the old living organisms that are preserved in sedimentary rocks are known as fossils.

Types of fossils and ways of formation

Fossils differ according to the ways of formation.

First type : Fossil of a complete body

Complete body fossil was formed when the organism died and was buried fast in a medium that preserved it from decomposition as in the case of snow or amber. It keeps the whole shape and all the details of the body.

Enrichment information (1)

In Latin, the word fossil means something buried in Earth. The science that studies fossils is Paleontology.

UNIT THREE

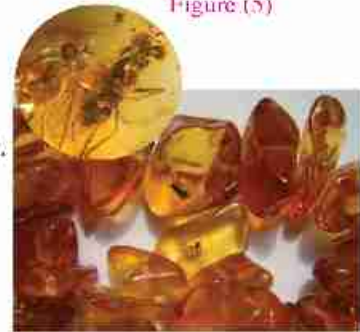
Examples of a complete body fossil:

Mammoth (It is a type of extinct elephants)
Figure (5)

1. Mammoth fossil :

A snow avalanche occurred in Siberia 25000 years ago. It caused the death of mammoth animal, which were also buried immediately in the snow.
When the first mammoth fossil was discovered in the last century, it was complete as the whole shape, and all hair, flesh and food in its bowels are all still completely preserved.

2. Amber fossil :

During some old geologic periods, there were common pine trees. These trees secreted resinous matter. This matter covered insects, After the resinous mater had been solidified it was changed into amber and preserved the bodies of these organisms burried inside it from decaying (Fig. 6).

Insects in amber
Figure (6)

Second type : mold

Participate with your group in doing the following activity. Each student makes a different model.

Activity (2) Making model of a mold

Materials and tools :

- Plaster of paris.
- Plastic container.
- Water.
- Metal mold.
- Food oil.
- Rod for stirring.
- Brush.

Procedures :

1. Use the brush to paint the internal surface of the mold with oil.
2. Mix plaster of paris with water and continue stirring to a suitable mixture.
3. Pour the mixture in the mold and wait until the plaster of paris solidifies (Fig. 7).
4. Separate the hard mixture from the mold (Fig. 8).

Figure (7)

Observation :

What do the details on the external surface of hard plaster show?
....

Conclusion :

Figure (8)

The hardened plaster of paris forms a solid mold of the metal mold.

Formation of a solid mold

1. When a snail (or clam) dies, it falls on the sea floor and is buried in sediments.
2. The sediments fill up the shell cavities and is solidified as the time passes.
3. The shell could decompose completely, leaving a rock mold carrying the internal details of the snail. (Fig. 9)

Ammonites fossil mold
Figure (9)

Real-life application | **Candle mold**

- Melt paraffin wax or wax remains in a water bath.
- Roll a piece of strong paper into a cylinder. Put it in an empty yoghurt can and then pass a thick thread through the cylinder.
- Pour the melted wax in the cylinder, keeping the thread in the middle all time.
- Remove the paper from around the wax after it solidifies. Put the candle in a suitable glass saucer (Fig. 10).

Candle mold
Figure (10)

Third type : cast and print:

Activity (3) **Make a model of a cast**

Participate with your group in doing the following activity, each student makes a different model.

Materials and tools :

- Coloured clay.
- A shell of a clam.

UNIT THREE

Procedures :

Shell cast
Figure (11)

1. Press on the clay by your hand to make a plane surface.
2. Put the shell on the surface of the clay and press it gently.
3. Remove the shell from the clay.

Observation :

What do the details on the clay indicate? ....

Conclusion :

A replica of the original outer shell shape is formed and it is known as cast.

- What a dead body of an organism leaves on sedimentary rocks is called cast (Fig.12)?
- What a living organism body leaves during its life is known as trace. (Fig.13)?

Dinosaur foot print
Figure (13)

Fish cast
Figure (12)

Exercise (1)

Choose the correct term (mold – cast – trace) for each of the following fossils:

Fossil .... of ferns
Figure (14)

Fossil .... of worms' tunnels
Figure (15)

Fossil .... of trilobite
Figure (16)

Fourth type : Petrified fossils

A type of fossils where the minerals can replace the organic matter of organism part by part without changing the shape, for examples:

Petrified Dinosaur's tooth
Figure (17)

Petrified Dinosaur's eggs
Figure (18)

Petrified wood
Figure (19)

Activity (4) Describing petrified wood

Visit with your classmates the petrified wood protectorate in Qattamiya and observe the petrified stems and trunks of trees that are more than 35 million years in age (Fig. 19).

Observation :

Are these trees rocks or fossils? ……………………………..................……………………..

Conclusion :

1. Petrified woods look like rocks but they are fossils because they give us details about once living old plant.
2. Petrified wood was formed by replacing , part by part, of the original wood material by silica, and this is known as "petrification"

Enrichment information and activity (2)

*An Egyptian dinosaur has been discovered in Bahariya Oasis, 6th October Governorate, and parts of it are being displayed in the Egyptian Geological Museum.

*Search for the Egyptian Geological Museum in the internet and write a report about it.

Importance of fossils:

and wide geographical rangev

Fossils are important because they help in:

1. Age determination of sedimentary rocks
Fossils of the organisms that lived a short period of time in the past and wide geographical range and became extinct are known as index fossils. They indicate the age of sedimentary rocks, becaus the age of rocks is the same age of fossils existed in them.

2 Figuring out the paleoenvironment:

Fossils give an idea about the environment in which they lived during the old geological ages. Therefore, they could also indicate the climate of these ages as shown in the following examples:

Nummulites fossil
Figure (20)

Ferns fossil
Figure (21)

Coral fossil
Figure (22)

Nummulites fossils:

Figure (20):

They are found in the limestone rocks Mokattam's mountain and indicate that there was a sea **floor in this area more than 35 million years ago.**

Ferns fossils:

Figure (21):

They indicate that the environment where they lived was a hot and rainy tropical environment.

Coral fossils:

Figure (22):

They indicate that the environment where they lived was clear, warm and shallow seas.

Exercise (2)

How can you infer from the presence of coral fossils in an area to know its past climate?

....

3 Studying life evolution :

Studying the fossil record showed that the life started first in sea, then established on land and organisms evolved always from simple to complicated higher forms. Algae preceded mosses and ferns. Gymnosperms appeared before Angiosperms. Invertebrates such as corals and mollusks **with shells appeared before vertebrates. The first vertebrate to appear was the fish, followed by amphibians and reptiles and finally. Birds and mammals appeared together after** the reptiles.

Archaeopteryx fossil links between reptiles and birds
Figure (23)

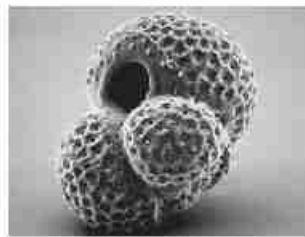
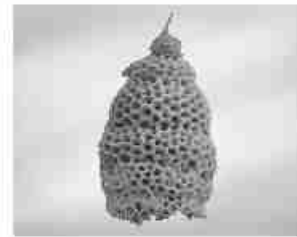
Exercise (3)

Arrange the following fossils according to their appearance on the life stage:
(Mold fossil of fish – Mammoth fossil – Trilobite fossil – Archaeopteryx)

....

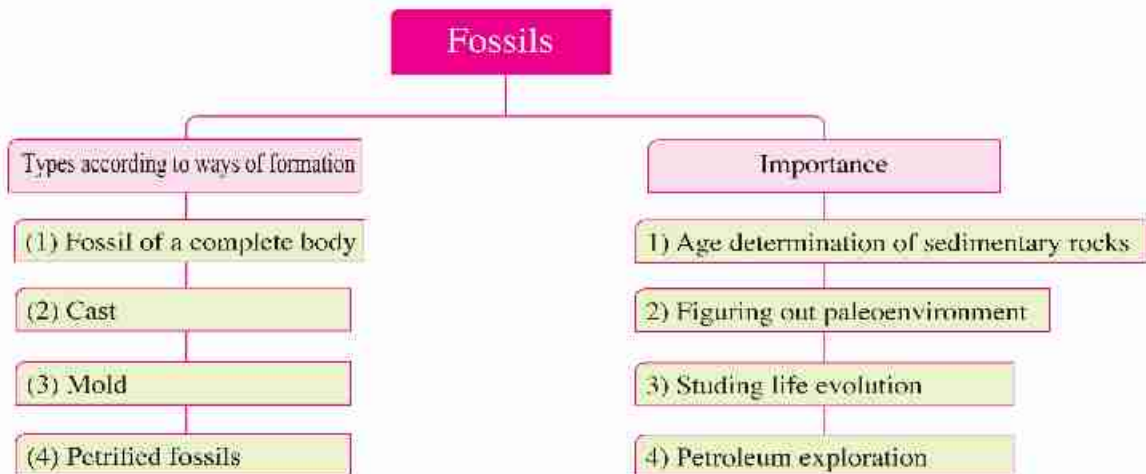
4 Petroleum exploration:

When searching for petroleum, geologists take samples from the rocks of the exploratory wells. These sample are studied microscopically. If they contain microfossils like foraminifera (Fig. 24) and radiolaria (Fig. 25), this could be a good indication of the age of the rocks from which they were taken. and the suitable conditions for petroleum formation.

Foraminifera
Figure (24)

Radiolaria
Figure (25)

A case for discussion | The geological heritage

Abu Roash Area in 6th October Governorate is considered an educational field for geology students as it is rich in layers and fossils from the cretaceous age which are rare in North Egypt. However, heavy construction projects are carried out there. Guided by your teacher, discuss with your classmates this issue taking into account the following questions:

- Do you prefer to convert this area into a natural protectorate or you agree to remove rock layers to build houses for the villagers?
- Is there any relation between the civilization of nations and conservation of their geological heritage?
- What would you do if you came across a valuable fossil?
- What do you suggest to preserve the geological heritage?

Lesson summary

- Fossils: Are remains or traces of organisms that lived in the past and were preserved in sedimentary rocks.
- Index fossils indicate the age of the sedimentary rocks in which they are found.
- Fish is first vertebrate to appear, followed by amphibians, then reptiles and finally birds and mammals appeared together.

Revision of lesson 1

1 Write the scientific term for each of the following statements:

(1) Fossils of old organisms that lived in the past for a certain period and then became extinct. (……………)

(2) Replacing, part by part, the wood material of trees by silica to form petrified woods. (……………)

(3) Remains or traces of organisms that lived in the past and were preserved in sedimentary rocks. (……………)

2 Complete the following phrases:

(1) Archaeopteryx represents the link between …………….. and ……………………………

(2) Fossils are used in …………… exploration and determining the age of …………………….

3 Choose the correct answer from between brackets:

(1) …………….. is an example of microfossils.
(Mammoth / Ferns / Foraminifera / archaeopteryx)

(2) Complete fossils of insects are found preserved in ……………………………………
(ammonites / amber / igneous rocks / ambergris)

4 Mention the importance of each of the following:

(1) Coral fossil ……………………………………………………………………………

(2) Nummulites fossil ………………………………………………………………………

5 What is the difference between ?

(1) Trace, Cast and Mold.

……………………………………………………………………………………………

(2) Cast and Mold.

……………………………………………………………………………………………

6 Give reasons for:

(1) Naming the petrified forests with wood mountain.

……………………………………………………………………………………………

(2) El-Mokattam's mountain was once a sea floor more than 35 million years ago.

……………………………………………………………………………………………

7 Mention the name and type of each fossil illustrated in the following figures:

(1) ....

(2) ....

(3) ....

(4) ....

(5) ....

(6) ....

8 Mention the suitable conditions for fossil preservation (as you studied in this lesson)

....

....

9 Creative thinking:

Your shoe was casted on a wooden mold resembling the shape of the foot.
Mention as many types of molds as you can that are being used in different purposes around you..

Activity

Consult your teacher about the suggestion of making a trip to Gebel El-Mokattam to collect samples of limestone rocks that contain fossils of nummulites to decorate your class or keep them in the museum of the science society of your school.

Lesson 2

Extinction

Second lesson :

Aims of the lesson

1. Identify the concept of extinction.
2. From the fossils in ference the extention of som living organisms.
3. Identify the factors which lead to the extenction of some living organisms.
4. Give examples for some extenced species and those are threatened with extenction.
5. Illustrates the effect of extenction on the ecological balance.
6. Mentain the living organisms threatened by extenction.
7. Deal in concieous with the environment according to his appreciation of the importance of natural life.
8. Appreciate the importance of the living organisms in biological balance.
9. Deal gentilly with living organisms.
10. Appreciate the effort of scientists in protection of living organisms.
11. Appreciate the effort of goverment in protection of living organisms.

Elements of the lesson

1. Concept of extinction.
2. Factors leads to the extinction of species.
3. Types of extinction and species threatemet extinction.
4. Effect of the extinction on the ecological balance.
5. Ways of protect living organisms.

Included cases

1. Extinction.
2. Environmental pollution.
3. Prevention of cruelty to animals.
4. Ecological equilibrium.

UNIT THREE

Extenction :

From your previous study, you know that the living organisms are always, in case of equilibrium. The number of certain kind of the organisms doesnot exceeds the number of another species. The continous decrease in number of other species without compunsation of this decrease in number as a result the death of all indvidvals of this species which known as extinction.

Extenction : The continous decrease in the numbers of living organisms without cempansating this decrease death of all individuals, in each species.

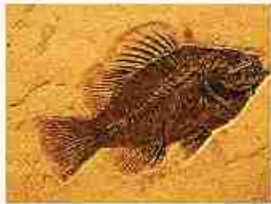



Figure (1)
Fish's fossil

Figure (2)
Dinosaur 's fossil

Figure (3)
Archaeopteryx fossil

Reasons of extinction :

- Many scientists attributed macro extinction which many living organisms lived on earth exposed to like extenction of dinasaures is due to occurance of big disasters like collesion of meteors with earth, violent earth movement, exposure of earth to long ice age, or as a result of toxic gases which evolved from volcanoes and many other factors.

- While other scientists attributed recent extinction due to human interference of human in environment like. destruction of the original habitate of the living organisms, overgrazing, pollution, climatic changes resulted from industrial activities of man and natural disasters (discus with your teacher and colleagues how these factors leads to extinction of living organisms).

Extinct species and that threated with extinction :

- From the farmous extinct living organisms in ancient periods: dinasaures, Mamouth (the grand father of recent elephant) and recent extinct animals such as Dodo bird, Quagga, and others.

Search in the web about living organisms which recently extincted and what have been extincted from egyptian habitates then discus it with your teacher.

Figure (4)
Dinosaure

Figure (5)
Mamonth

Figure (6)
Dodo bird

Figure (7)
Quagga

There are more than five thousand kinds of living organisms threatend with extinction like Rhinosour, Panda bear, bald eagle, and from the egyptian environment :
Ibis bird , Barbary sheep(Arui) , and papyrus Plant

Figure (8) **Panda bear**	Figure (9) **Rhinoceros**	Figure (10) **Ibis bird**
Figure (11) **Bald eagle**	Figure (12) **Barbary sheep (Arui)**	Figure (13) **Papyrus plant**

Effect of extinction on the ecological balance :

Study the food chain in figure (14) and observe how the energyptransfere across this food chain and then answer the questions illustrated in activity book page, then put a suitable conclusion.

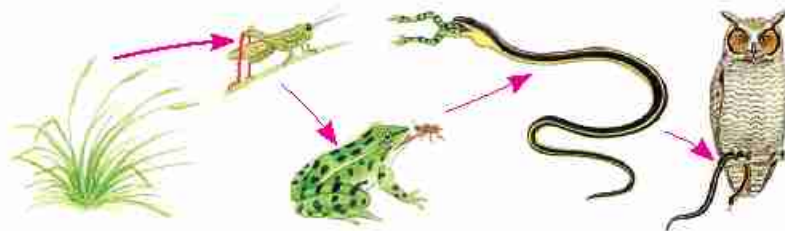



Figure (14) **Food chain**

- In the food chain, the energy transfere from producers to consumers.
- Each living organism has a role in transfere of energy in the pathway of the food chain.
- In case of absence of one of the living organisms, the role of this living organism stops, which affect on the other members of the food chain or on the food web (group of food chains connected with each other).
- At the extinction of one species or more from balanced ecosystem, some gaps occured in the pathway of energy inside this system which leads to a disturbance in the balanced ecosystem, and some times its distruction.
- The ecosystems are different from each other as a result of the effect of extinction on it : the simple ecosystem (less number of species) is affected strongly at the absence of one speices found in it due to absence of a substitute which compansate its absence and play its role as in the desert ecosystem [Figure (15)].
- While in the complex ecosystem (large number of species) it does not much affected by the absence of a species of a living organism found in it due to the presence of many substitution which can compansate its absence, as in the ecosystem of tropical ecosystem [Figure (16)].

Figure (15)
Desert ecosystem
ecosystem with less number of species (less kinds)

Figure (16)
Tropical forest ecosystem
Complexs ecosystem (many kinds)

Ways of protection of living organisms from extinction

It was necessary for the scientists to think in ways of protection of species endangered by extinction to keep the ecological balance and so the ecological systems from distruction. From these methods :

1. Put laws which regulate the process of hunting of living organisms especialy the rare animals or that threated with extinction.

Figure (17)
Grey bear

2. Increase the ecological awarness of the importance of the preservation of the natural life which guarantee the continouity of human life.

3. Breeding and increasing the endangend species and re-habitation in its original environments.

4. Establishing genes banks for the endangered species.

5. Establishing of natural protectorates to preserve the endangered species with extinclian.

Figure (18)
Ras Mohamed protectorate
(shaped as a chin)

Figure (19)
Whale fossil

Natural protectorates

are safe places established to protect endangered species in their natural places where suitable conditions are available for their growth and reproduction away from their natural enimies. From these protectorates, yellow stone in united states of america, where the grey bear is are protected, and the Panda bear protectorate in northeast of china to protect the Panda bear.

In Egypt, Ras Mohamed protectorate had been esrablished in 1983 in south Sina as the first protectorate in egypt to preserve some rare species of coral reefs and colored fish and wadi El-Rayan protectorate in fayoum which contains wadi El hetan (Wheals vali) that contains skeletons of wheals fossils that are dated to be as old as 40 million years.

Enrichment information ( ) :
Number of natural protectorates that had been established according to the law (number 102 year 1983) about 30 natural protectorates till 2012 which found on a bout 15% of total area of egypt.

Summary of the lesson

Extinction

which mean

Continous decrease in the number of individuals of a certain species of living organisms

Extincted species example: Dinasaures, mamouth

methods of protection of endangered species

from it

Establishing natural protecturales to pres erve the endangered species like Ras Mohamed protectorate in egypt.

Endangered species examples : Rhinocerose, Panda bear, bald eagle, Ibis bird Barbary sheep (Arui), Papyrus plant.

Effects of extinction on the ecosystem

destroy the simple ecosystem

Little effect on the complicated ecosystem

Revision of lesson 2

1 Choose the correct answer from between brackets:

(1) ……….. indicate(s) extinction.
(Fossils / Protectorates / Evolution / Ecological equilibrium)

(2) ………. protectorate is the first established natural protectorate in Egypt.
(Saint Cathrine / Ras Mohamed / Wadi Hetan / Petrified forest)

2 Write the scientific term for each of the following statements:

(1) The death of all members of species of living organisms. (……………)

(2) Safe places established to protect endargered species. (……………)

3 Mention the most important factors that cause species extinction

……………………………………………………………………………………………………

……………………………………………………………………………………………………

4 Explain the effect of extinction of a species of living organisms on:

(1) Simple ecosystem ………………………………………………………………………

(2) Complicated ecosystem …………………………………………………………………

5 Mention what characterize each of the following:

(1) Ras Mohamed protectorate.

(2) Wadi Hetan area.

6 Exclude the unsuitable word and mention what the rest has in common:

(1) Dodo / Quagga / Bald eagle / Mamouth

……………………………………………………………………………………………

(2) Panda / Rhinoceros / Quagga / Bald eagle

……………………………………………………………………………………………

7 Give reasons for:

(2) The desert ecosystem is significantly affected by the absence of one of its species.

....

Unit Revision

1 Choose the correct answer from between brackets:

(1) Fossils are often found in .... rocks. (metamorphic / sedimentary / volcanic / igneous)

(2) All of the following are endangered species except ....

(panda / bald eagle / quagga / rhinoceros)

(3) All of the following are natural disasters that threaten the living organisms except ....

(floods / volcanoes / drought waves / global warming)

2 Define each of the following:

(1) Fossil: ....

(2) Index fossil: ....

(3) Natural protectorates: ....

3 Correct the following statement without changing the underlined phrases:

(1) The first discovered fossil of mammoth were found preserved in amber.

....

(2) Ferns fossils indicate that they lived in mild environment.

....

(3) Destroying the habitat is one of the factors that contribute to species adaptation.

....

4 Mention three ways to protect living organisms from extinction:

....

5 Give reasons for:

(1) Petrified woods are considered from fossils although they look like rocks.

....

(2) Fossils are important in petroleum exploration.

....

(3) The simple ecosystem is significantly affected by the absence of one of its species.

....

6 Which does represent mold or cast in each of the following:

(1) Gold alloy: ....

(2) Cubes of ice: ....

(3) Wax Museum statues in Helwan : ....

(4) Models of clothes shows : ....

(5) Face of a coin on clay: ....

Links for 2nd prep.(1st Term)

Unit	Lesson	Content of link	QR code
One	Periodicity of elements and their properties	Metals and nonmetals	
	Water	The importance of water for life on Earth	
		The molecular structure of water	
		The chemistry of water	
Two	Atmospheric layers	Atmosphere	
		Atmospheric layers	
	Ozone Layer	Green house Effect	
Three	Fossils	Amazing fossils	
	Extinction	Extinction	

Al Kwmia Press

قائمة المراجع المستخدمة فى تأليف الكتاب

المراجع العربية

(١) موسوعة المشاهدة العيانية (الكيمياء) – أحمد شفيق الخطيب – مكتبة لبنان ناشرون

(٢) القانون العظيم فى الكيمياء – د. تريفونوف – دار مير للطباعة والنشر

(٣) الموسوعة العلمية المعاصرة – أحمد شفيق الخطيب – دار مير للطباعة والنشر

(٤) الأرض تدافع عن نفسها (الماء) – باميلا جرانت – مكتبة الأسرة

(٥) دليل استخدام معامل العلوم المتطورة للمرحلة الإعدادية – وزارة التربية والتعليم

(٦) الكيمياء فى خدمة الإنسان – رولاند جاكسون – الهيئة المصرية العامة للكتاب

(٧) التلوث البيئى وأثره على صحة الإنسان – د. محمد السيد أرناؤوط – مكتبة الأسرة

(٨) قصص وطرائف عن الفلزات – ترجمة عيسى مسوح – دار مير للطباعة والنشر

(٩) سلسلة ألفا العلمية (الأعاصير والعواصف) – نيكولا باربر – مكتبة العبيكان

(١٠) بيئتنا مستقبلنا (أزمة المناخ) – أكاديميا

(١١) المناخ والطقس – إبراهيم حلمى – دار الشرق العربى

(١٢) السلامة من الكوارث الطبيعية – جمال صالح – دار الشروق

(١٣) موسوعة الأجيال (الطبيعة) – الأجيال للترجمة والنشر

(١٤) استكشف العالم والكون (الغابات) – مكتبة لبنان ناشرون

(١٥) موسوعة الأرض المبسطة (الغابات) – مكتبة لبنان ناشرون

المراجع الأجنبية

(1) HOLT Chemistry - HOLT RINEHART WINSTON

(2) Chemistry - J A Hunt and A sykes - Longman

(3) Chemistry (PRINCIPLES and REACTIONS) - Harcourt

(4) Chemistry - ZUMDAHL ZUMDAHL - HOUGHTON MIFFLIN

(5) KEY SCIENCE (Chemistry) - Eileen Ramsden - Stanley Thornes

(6) ASTRONOMY - John D. Fix - M Mosby

(7) Environmental GEOLOGY - Carla - WCB

(8) BIOLOGY (PRINCIPLES & EXPLORATIONS) - HOLT RINEHART WINSTON

(9) BIOLOGY (The unity and Diversity of life) - Wads Worth